JUNE

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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FIFTY CENTS

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ARTHUR R. McDOWELL, D.D.S., San Francisco, Calif.
President of the American Association of Dental Schools

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Original Communications

HIGH SUGAR DIETS AND DENTAL CARIES IN THE WHITE RAT*

By C. D. MARSHALL DAY,† B.D.S., D.M.D., M.S.; R. G. DAGGS, Ph.D., and H. J. SEDWICK,† D.D.S., Rochester, N. Y.

REVIEW OF LITERATURE

Clinical Investigation.—The doctrine that sugar as such exerts a harmful influence on the teeth has been taught by the dental profession and accepted by the public from the earliest times.

From the time of Aristotle to the present day, this idea has been reiterated by investigators, with but few exceptions. Sometimes, such a statement has been merely an expression of opinion. Sometimes, the opinion has been supported by personal observation, clinical evidence and, more rarely, scientific investigation.

It is a noteworthy fact, and one on which much emphasis is placed by the proponents of the sugar-fermentation theory of dental caries, that the increase in the incidence of caries among modern races closely parallels the increase in sugar consumption over the same period. At the beginning of the eighteenth century in England, the amount of sugar imported per head was 3 pounds per annum.[1] In 1819, it was 17 pounds; in 1905, 74 pounds, and by 1928-1929, it had increased to 101 pounds per head per annum. In some countries, the amounts are even greater. The figure for Australia and Denmark is 112 pounds,[2] and for New Zealand, 122 pounds per annum. In the United States, the sugar consumption per person per year has increased from 11 pounds, in 1800, to approximately 115 pounds at present.[3]

*From the Departments of Vital Economics and Anatomy, University of Rochester.

*Read before the International Association for Dental Research, Chicago, Ill., March, 1934.

†Rockefeller Fellow in Dentistry.

1. Colyer, J. F., and Sprawson, Evelyn: Dental Surgery and Pathology, Ed. 6, London: Longmans Green and Co., 1931, p. 344.

2. Paton, J. H. P.: D. Cosmos, 74:1232 (Dec.) 1932. J.A.M.A., 99:1729 (Nov. 12) 1932.

3. McCollum, E. V., and Simmonds, Nina: Food Nutrition and Health, Ed. 2, 1931, p. 51.

In an article decrying "the lamentable results of the vitamin campaign," Sim Wallace,[4] who regards sugar as the "arch-demon of dental decay,"[5] refers to the Cambridge (England) Borough report for 1929 indicating the percentages of carious temporary teeth in the 5-year-old group of children in the Borough from 1909 to 1929.

Between 1917 and 1922, this percentage fell steadily from 35 to 12; while from 1922 onward, it has been rising again and now stands at 21. Grandison, who is responsible for this report, makes the following comments "whether by the blood circulation (internal metabolism) or by direct action on the enamel of the teeth, it seems probable that the children who were 5 years old in 1922 and whose temporary teeth showed decay amounting to only 12.2 per cent benefited to no small extent by the rationing process." It is significant that, during the war period, the scarcity of sugar and sugary foods was a predominant feature.

Prof. Middleton Shaw,[6] who is just as heartily opposed to the Mellanby and other deficiency theories of dental caries, states *inter alia*, "There is no evidence of degenerative changes in the microscopic

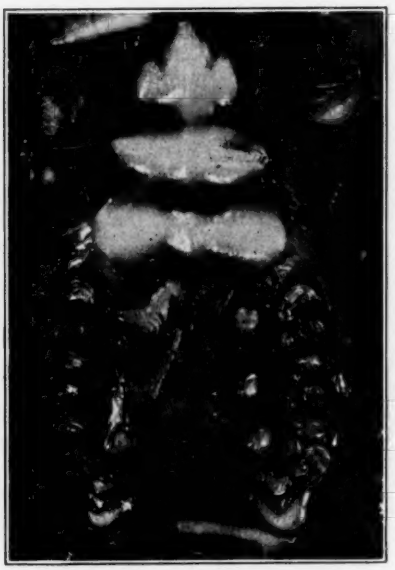

Fig. 1.—Low-power photomicrograph showing plaque formation on maxillary molars of rat of Group II, maintained on 45 per cent basal diet + 55 per cent fudge.

Fig. 2.—Low-power photomicrograph showing plaque formation on maxillary molars of rat of Group V, maintained on 42.7 per cent basal diet + 55 per cent fudge + 3.3 per cent Osborne-Mendel salt mixture and daily allowances of cod liver oil and dried yeast.

4. Wallace, J. S.: New Zealand D. J., 28:135 (March) 1933.

5. Wallace, J. S.: D. Items Int., 55:18 (Jan.) 1933.

6. Shaw, J. C. M.: S. Afr. M. J. 6:147-151 (March 12) 1932.

structure of the teeth of civilized man as contrasted with those of his remote ancestors. . . . We may drink cod liver oil at each and every meal, and bathe in sunshine for the remainder of our lives, but if at the same time we continue to consume sugar as we do at the present, the last state of our teeth will be no better than the first."

The opinion of Pickerill[7] with regard to sweets and their effect on the teeth may be summed up in the following quotation. "All are good in that they are salivary stimulants and all are bad in that they are readily fermentable; and as a general rule it may be said that the ill-effects quite outweigh the good effect. They all leave sugar behind in the mouth to be transformed into lactic acid—chocolate and caramels most of all." He believes that a growing child can obtain all the sugar for its bodily requirements from the consumption of it in a natural form as found in fruits and vegetables. These views are in agreement with those expressed in the annual report of the committee on nutritional problems of the American Public Health Association.[8] This report emphasizes the fact that sugar contributes nothing of food value except as a source of calories, which can be supplied in other forms to better advantage along with liberal supplies of body-building materials, so necessary for growing children. In pointing out the peculiar appetite-blunting properties of sugar, Sherman makes the following recommendation: "The proper place for sugar is not in such concentrated forms as candy nor in the indiscriminate and excessive sweetening of all kinds of food . . . but to facilitate the introduction into the dietary of larger amounts of vitamin- and mineral-carrying foods such as milk."

Fig. 3.—Low-power photomicrograph showing plaque formation on maxillary molars of rat of Group IV, maintained on 80 per cent basal diet + 20 per cent fudge.

Statistics gathered from the state schools in England seem to show that the poorest children have the best teeth. Clinical experience also leads one to the conclusion that orphanage children possess a greater degree of immunity to dental caries.

Whether this apparent lessened susceptibility is due to a simpler dietary régime or to the lack of means to purchase sweets, cakes and various forms of the highly refined and fermentable carbohydrates has never been satisfactorily established. Nor has it been definitely proved by those who subscribe to the view that sugar is harmful to the teeth that the

7. Pickerill, H. P.: Prevention of Dental Caries and Oral Sepsis, Ed. 3, New York City: Paul B. Hoeber, Inc., 1924, p. 132.

8. Sherman, H. C., et al.: Am. J. Pub. Health, 19:1205-1209 (Nov.) 1929.

benefits which are said to accrue from its elimination from the diet are due to the ingestion of the more desirable food elements or to the reduction to a minimum of the sticky and fermentable carbohydrates and consequent decrease in lactic acid production. Bunting[9] suggests that the superabundance of sugars may interfere with the proper metabolism of calcium.

The comparative susceptibility to caries of bakers and millers, which is frequently referred to in the literature, is usually ascribed to the continual inhalation into the mouth of highly fermentable carbohydrates in a fine state of division. The teeth of confectionery workers are said to suffer in a like manner.

Similarly, the occurrence of rampant caries in the maxillary incisors of Japanese infants in Hawaii is said by some to be due to the Japanese practice of quieting their children with small bags containing sugar. Harris[10] refers to the association of the rapid decay of the incisors of infants with the use of a comforter coated with some sugary substance. Furthermore, it has been noted that the islanders of Tristan da Cunha who seldom eat sugar are almost immune to dental caries.

Colyer and Sprawson[11] report an examination of 5,586 children in Shropshire, England, which disclosed that the incidence of dental caries was in direct proportion to the quantity of sugar taken in the form of "sweets," exclusive of sugary foods taken at meal times.

There would thus seem to be considerable clinical evidence in support of the contention that sugar in excessive amounts is detrimental to the teeth.

On the other hand, Bing,[12] in a report prepared for the Council on Dental Therapeutics, states that the present concensus of opinion is that sugar in itself has no harmful effect, but that it may lead to a relative deficient intake of other necessary food substances.

Osman[13] points out that a deficiency of sugar generally means excess of fat, which leads not only to the production of abnormal substances such as the ketones but also to an increased catabolism of protein. In his opinion, a larger proportion of school children are suffering from a relative sugar deficiency, especially since the importance of the fatty foods, particularly those containing vitamins A and D, has been given such prominence. In view of these facts, Osman doubts whether the evidence offered against the use of sugar from the dental point of view is still sufficient to justify its condemnation.

Among the reasons given by Bödecker[14] for maintaining that the chemicoparasitic theory of Miller does not explain dental caries in all its phases are the following: (1) the fact that teeth do not always decay in the presence of fermentable food débris; (2) the apparent increased susceptibility to dental decay during pregnancy and systemic illnesses; (3) the occurrence of approximal decay affecting only one of the two adjacent teeth, and (4) the fact that mottled enamel, which appears to be poorly calcified, is not more susceptible to decay than normal enamel. Furthermore, Miller was unable to explain, except on the basis of tooth structure or form, the immunity of such animals as swine, which live almost entirely on fermenting foods and whose saliva has

9. Bunting, R. W.: Diet and Its Relation to Prevention of Dental Caries, J.A.D.A., 11:74 (Jan.) 1924.

10. Harris, E. H.: Lancet, 2:1327 (Nov. 11) 1911.

11. Footnote 1, p. 346.

12. Bing, F. C.: Diet and Teeth, J.A.D.A., 19:1848 (Oct.) 1932.

13. Osman, A. A.: Proc. Roy. Soc. Med., Sect. Odont., 24:1103-1110, 1931.

14. Bödecker, C. F.: D. Cosmos, 71:586-598 (June) 1929.

been estimated to contain many times the number of bacteria present in that of individuals very susceptible to dental caries.

From an extensive investigation into the causes of decay in Hawaii, Jones, Larson and Pritchard[15] reached the conclusion that "candy and sweets *per se* do not appear to be factors in the high incidence of decay in Hawaii." These investigators further reported that certain diets containing as much as 75 per cent of the calories in the form of carbohydrates may be compatible with sound bone and tooth structure.

In striking contrast is the conclusion reached by Wilkins[16] following an investigation into the causes of decay in New Zealand. He found that the incidence of carious teeth in Birmingham (England) and in New Zealand was in the ratio of 1:4 in the age group 12-22; and this in spite of the greater prosperity and better standard of home life in New Zealand, combined with a dietary richer in protein and antirachitic substances. Wilkins is of the opinion that the dietary habits of the people are to blame for the high caries incidence, and instances the extremely high sugar consumption and the frequency with which subsidiary meals, usually of a highly fermentable nature, are taken throughout the day.

On the other hand, Sprawson[17] reports an investigation recently conducted in England to study the specific effect of raw milk on the teeth. He found that forty children brought up from 4½ months on raw milk showed at an average age of 4 years no incidence of dental caries, although on a diet rich in refined carbohydrates.

Boyd, Drain and Nelson,[18] who regard dental caries not as a matter of local mouth health, but rather as a problem of maintenance of normal body function, had under observation various groups of diabetic children. In four groups under divergent dietary management, they claim that caries has been arrested and controlled. In one group, the calories were supplied principally as simple sugars, and fats avoided as much as possible. In another, fats furnished most of the energy and only enough carbohydrates were used to render the diet antiketogenic. Each child received every day cod liver oil, milk, orange or tomato juice and vegetables sufficient to meet the vitamin and mineral requirements. In no instance was there any evidence of a relationship between sugar or carbohydrate consumption and dental caries; nor has it ever been demonstrated that diabetics whose sugar and other carbohydrates have been largely eliminated from the dietary are more nearly immune to dental decay. Boyd, *et al.* believe that if extensive use of sugars and starches is found associated with caries, it is probably to be explained by the fact that their use in excessive amounts may lead to the omission from the diet of other essential food elements, which, in turn, may render the teeth more susceptible to decay. Their point of view is in accord with that of McCollum.[19]

Bunting, Delves and Hard[20] conducted an investigation involving more than 300 children who were kept on a

15. Jones, Martha; Larson, N. P., and Pritchard, G. P.: D. Cosmos, 72:699 (July) 1930.

16. Wilkins, E. H.: Brit. J. D. Sc., 48:27 (Oct.) 1927.

17. Sprawson, Evelyn: J. D. Res. 13:250 (April) 1932.

18. Boyd, J. D., and Drain, C. L.: Dietary Control of Caries, J.A.D.A., 17:740 (April) 1930. Boyd, J. D.; Drain, C. L., and Nelson, M. V.: Am. J. Dis. Child., 38:721-725 (Oct.) 1929.

19. McCollum, E. V.: M. Searchlight & Sc. Bull., 8:1, 1932.

20. Bunting, R. W.; Delves, Edna and Hard, Dorothy G.: Proc. Soc. Exper. Biol. & Med., 27:426-427, 1930.

prescribed diet. Always included in the daily menu were green vegetables, fruit and 1 quart of milk. Sugar and white flour were eliminated as far as possible. They reported the arrest of dental caries in a large percentage of the children. Whether the elimination from the dietary of sugar and other refined carbohydrates had any bearing on the results is merely a matter for conjecture. Bunting himself is of the opinion that the findings indicate the importance of an adequate and well-balanced diet rather than the inclusion or omission of any one food factor.

Following a survey carried out at the University of Southern California, Hawkins, Hendricks and Hills[21] stated that "a heavy consumption of sugar is a cause of caries," but found no indication as to whether this was due to local or systemic conditions or to a combination of the two.

Previous Experimental Work.—In addition to clinical investigations, some experimental work has been done with laboratory animals in an attempt to arrive at a definite conclusion with regard to the effect of sugar on the teeth.

Reporting an experiment designed to study the effects of high sugar diets on the growth and structure of the rat, Jackson[22] stated that "high sugar diets for long periods are not necessarily injurious to the teeth." Thirty-six rats were used from weaning until 148-200 days of age. Of these, fifteen acted as controls, receiving 45 per cent cooked corn starch with an otherwise adequate diet. Of the remainder, fifteen received 45 per cent commercial sucrose in place of the corn starch, while six received 80 per cent sucrose. Jackson reported "a few small carious spots" on the molars, but stated that these occurred with equal frequency in the control and test groups.

Bunting[23] reported that a group of rats fed on a very deficient but carbohydrate-free diet showed no sign of dental caries, for "without carbohydrates the aciduric organisms could produce no acids of caries nor could they live in the mouths of animals so fed." Bunting stated further that when considerable quantities of sugar were fed to rats receiving an otherwise normal and adequate diet, dental caries was very prevalent. Apparently, the animals were given the sugar and regular ration separately and by choice ate the sugar first. The prevalence of caries may have been due not to the sugar *per se,* but to the crowding out of the diet of other essential food elements present in the normal ration.

Howe,[24] who used guinea-pigs for a similar study, found that feeding fermentable starches and sugars for twelve months did not produce decay. It must be remembered that, unlike the molars of the rat, the molars as well as the incisors of guinea-pigs are of persistent growth. The continual attrition and replacement of the coronal portion would thus militate against the formation of cavities, or at least largely negate the importance of the time factor. Howe[25] also fed sugar and white flour to monkeys *(Macacus rhesus)* in such a manner that it adhered to the teeth and in addition fed a candy made from water and cane sugar. In two animals so fed for eight and one-half months, no caries was found.

21. Hawkins, H. F.; Hendricks, W. W., and Hills, N. R.: Cause and Prevention of Dental Decay, J.A.D.A., 15:354-361 (Feb.) 1928.

22. Jackson, C. M.: J. Nutrition, 3:61-67 (July) 1930.

23. Bunting, R. W.: D. Cosmos, 72:404 (April) 1930.

24. Howe, P. R.: D. Cosmos, 62:21 (Aug.) 1920.

25. Howe, P. R.: Dental Disorders Following Experimental Feeding with Monkeys, J.A.D.A., 11:1157 (Dec.) 1924.

Lilly[26] reports feeding white rats for one year on a diet 53 per cent of which was sucrose, without the production of dental caries. Nor did caries develop in rats fed a similar diet with triweekly oral inoculations of a pure culture of *B. acidophilus*.

Mellanby[27] likewise reported negative results of the addition of a large proportion of glucose to the diet of six dogs over a period of three years. This is of doubtful significance in view of the fact that it seems impossible to produce caries experimentally in dogs under any circumstances.

Shibata,[28] of Japan, believes that the absorption of excessive sugars is "the prime factor in the development of dental caries at the growing stage." He reports significant changes in enamel showing imperfect calcification.

In certain cases, enamel excrescences were found with abnormal development of the enamel cells. The latter phenomenon, spoken of by Shibata, seems to present some similarity to the condition reported by Wolbach and Howe[29] with rats on vitamin A deficiency. Here too, complete globules of calcified matrix appeared before atrophy of the enamel organ.

Shibata also reports changes in the dentin of the teeth of guinea-pigs, which were in the nature of a new growth of the osteoid dentin, and bleeding or a "strong atrophy" in the dental pulp.

Animals fed grape sugar, maltose and fructose were said to show significant caries within a shorter time than those tested with lactose and cane sugar, which have a lower acid fermentability. Shibata states that similar changes were experimentally shown by Masaki and by Wada with rabbits and mice. The diet used by Shibata was a compound of rice and greens mixed with only from 5 to 10 per cent of the various sugars. The rats were killed after an experimental period of only twenty to fifty days. Klein and McCollum[30] are of the opinion that caries can hardly be expected in the rat within less than 100 days of experimental feeding.

It is not impossible that some of the reported structural changes may have been brought about by the crowding out of the various vitamins by virtue of the high sugar intake; but this could not explain the destruction of the crowns of the molars in some cases within a week's time, as reported by Shibata. Moreover, the amount of sugar superimposed was remarkably small.

From a review of the available literature, it is obvious that the problem is still unsolved. The question as to whether sugar as such or in the form of candy or sweets is injurious to the teeth, either through local or systemic action, has never been conclusively answered. Even with experimental animals such as the rat, contradictory results have been obtained by different investigators.

It therefore seemed desirable to undertake a study of the problem, using a large number of laboratory animals maintained on high sugar diets from an early age and for a considerable length of time.

EXPERIMENTAL DATA

It was decided to use white rats for our study. These animals are omnivorous and moreover their molars are in many respects morphologically similar to the

26. Lilly, C. A.: J. Nutrition, 5:175 (March) 1932.

27. Mellanby, May: Brit. M. Res. Coun. Spec. Rep. Ser. 153, Diet and Teeth, Pt. II, 1930, p. 58.

28. Shibata, M.: Japan J. Exper. Med., 9:21 (Feb. 20) 1931.

29. Wolbach, S. B., and Howe, P. R.: Am. J. Path., 9:287 (March) 1933.

30. Klein, Henry, and McCollum, E. V.: J. D. Res., 11:745 (Oct.) 1931.

molars of man and are not of persistent growth as are those of the guinea-pig. More than 200 rats were used in all, not including those that died of intercurrent disease. These were divided into five groups including the control group and four test groups so that there was an equal distribution among the groups with regard to weight, age and sex. The weights at the beginning of the experimental period ranged from 24 to 300 gm., the average weight of the whole series being 165 gm. Seventy-three rats distributed among the five groups weighed less than 100 gm. at the beginning of the experiment.

The control group was kept proportionately large, as it was felt necessary to establish a reliable caries figure under the control conditions.

The basal ration used consisted of the Fox chow prepared by the Purina Mills at St. Louis, Mo. The published ingredients are: meat, wheat germ meal, dried skim milk, cod liver oil, barley malt, black strap molasses, oat cereal, corn cereal, wheat bran and iodized salt. Analysis shows the protein content to be 20.0; fat, 3.0; fiber, 6.0; nitrogen-free extract, 50; carbohydrate, 56, and ash, 6.0 per cent. The caloric value is given as 1,500 calories per pound and the calcium-phosphorus ratio as 1.4:1.0.

In view of the criticism which has recently been leveled at the basal diets used in many of the rat-caries experiments, because of the alleged initiation of the caries process through fracture by hard corn particles, special inquiries were made as to the mode of preparation of this ration. It was learned that the corn cereal mentioned in the formula is compounded of white corn grits, but this is cooked for an hour under steam pressure in a rotary steam cooker and later dried in a rotary steam drier. Thus, the danger of fracture of the cusps of the molars by corn grit particles is largely eliminated, and, it is believed, can be disregarded as a possible factor in dental decay in this experiment.

There are few coarse particles. Approximately 50 per cent was found to pass through a 60-mesh sieve and about 80 per cent through a 40-mesh sieve.

In order to approach as nearly as possible the conditions met in the human mouth, a popular type of chocolate fudge was chosen as the means of introducing the high sugar content into the diet. The figures given by Rose[31] for this particular type of candy are: protein, 2; fat, 20; carbohydrate, 78. It is very probable that the fat value for the cheap brand of fudge used would be lower and the carbohydrate value higher than Rose's figures. In view of the carbohydrate content (56 per cent) of the basal diet, the carbohydrate content of the diet as fed in the high-sugar groups is extremely high.

The 213 rats were arranged in groups as follows:

Group I: Controls (57 rats), basal diet alone.

Group II: Experimental animals (40 rats), 45 per cent basal diet + 55 per cent fudge.

Group III: Experimental animals (42 rats), 65 per cent basal diet + 35 per cent fudge.

Group IV: Experimental animals (40 rats), 80 per cent basal diet + 20 per cent fudge.

Group V: Experimental animals (34 rats), 42.7 per cent basal diet + 55 per cent fudge + 3.3 per cent Osborne-Mendel salt mixture.

In addition, Group V received a supplement of 3 drops of cod liver oil and 0.6 gm. of yeast per rat per day, individually fed.

In order to eliminate the possibility of

31. Rose, Mary S.: Feeding the Family, Ed. 3, New York: Macmillan Co., 1931, pp. 357, 395.

individual variation in predilection for the dietary constituents, the fudge was heated with the addition of a little water and melted to a gruelly consistency. After cooling to preserve the vitamin content of the basal ration, this was stirred in a little at a time and finally fed to the animals *ad libitum* in the form of a sticky adhesive mass.

The cod liver oil and yeast were fed daily to the rats in Group V to rule out the possibility in this group of a vitamin shortage through the addition of so large a proportion of sugar. The Osborne-Mendel salt mixture was added to ensure a sufficiency of minerals.

The dieting was continued for a period ranging from a minimum of 150 days to a maximum of 261 days and the rats were weighed weekly.

The animals were then killed and necropsy was performed, and the teeth were carefully examined under a binocular microscope, the fissures first being thoroughly cleansed of débris with the aid of fine explorers and the finest dental root-canal broaches. Many histologic sections were cut both longitudinally through the molars and transversely through the lower jaw in the region of the first molar at right angles to the longitudinal axis of the ramus of the mandible.

The sexes were segregated for the full experimental period, except for several rats from each group, which were bred at the end of 150 days, and the resulting litters together with the parents were similarly examined after a further period of 100 days' dieting.

EXPERIMENTAL DATA

Group	No. Rats	No. Teeth	Sugar in Diet Per Cent	Plaque	Débris	Incidence of Caries: No. Animals	Incidence of Caries: No. Teeth	Teeth Affected
I	57	912	0	0 – trace	+	1	1	Lower right second molar
II	40	640	55	+++	+++	2	2	Upper left second molar Lower right second molar
III	42	672	35	++	++	0	0	.....
IV	40	640	20	+ – ++	++	0	0	.....
V	34	544	55*	+++	+++	1	1	Lower right second molar
Total	213	3408				4	4	

*Minerals and vitamins added.

RESULTS AND COMMENT

Throughout the experimental period, the diet seemed to be relished by all groups. The average weight gains, although approximately uniform in all groups, were not strictly comparable in view of some individual variation in initial weights and the occurrence of a respiratory infection in some animals. At the end of the experimental period, the rats were normal and well-nourished, with

the exception of those that had developed lung lesions following respiratory infection. This condition was not confined to any one group and was wholly unrelated to the diet. The rats in the high-sugar groups showed a greater tendency to the deposition of fat in the tissues in direct proportion to the amount of sugar present in the diet.

Animals in all five groups were able to complete the reproductive cycle with the production of normal healthy offspring. After weaning, the second generation rats grew normally on the experimental dietaries until killed and necropsied at 100 days of age.

Separation of the upper and lower jaws and examination of the teeth disclosed (1) abnormal plaque formation; (2) considerable impaction of débris in the fissures and around the teeth; (3) a great number of enamel fractures; (4) almost complete absence of caries, and (5) a normal healthy periodontal condition. These data are presented briefly in the accompanying table.

Viewed with the naked eye, the plaque formation appeared as a dark brown stain around the necks of the teeth. Under the binocular microscope, it was seen that the apparent stain was a semitransparent encrustation, dark brown, closely adherent to the enamel surface and extending along the cervical margin and sometimes over the mesial, buccal or palatal surfaces and into the fissures of the molars. The anterior molars were always most affected and the teeth of the upper jaw were always much more heavily encrusted than those in the mandible, no doubt owing to the greater cleansing action of the tongue and saliva in the lower jaw.

This deposit appeared without exception in all animals in Groups II, III, IV and V, and the amount varied always in direct proportion to the concentration of sugar in the diet. When the plaque was removed, there was no evidence of enamel decalcification. Figures 1-3 serve to illustrate these conditions as viewed under the binocular microscope.

Figure 1 is a photograph, considerably magnified, of the superior maxillary molars of an animal in Group II, and Figures 2 and 3 are similar representations of Groups V and IV, respectively. The condition met with in Group III was intermediate between that found in Groups II and IV. Of the fifty-seven animals in Group I and on the basal diet alone, sixteen showed a trace of dark brown stain, but in no instance was there any plaque of the type present in all animals of the other four groups which were fed a high-sugar diet.

The amount of débris between the teeth and impacted in the fissures paralleled to some extent the degree of plaque formation found in the five groups. The different consistency of the diets was no doubt responsible for the greater amount of débris present around the teeth of rats on the high-sugar diets. In many instances, impactions of corn grit particles were particularly severe and it required considerable force to dislodge them. This fact is of interest in the light of the work of Rosebury, who claims that forcible impaction of cereal particles is necessary for the production of caries in rats. He has not yet produced caries other than by this means.

The considerable variation in the depth of the molar fissures was sometimes due in part to differences in anatomic form of the teeth; but, in most cases, this variation was brought about by differences in the degree of attrition that had taken place. Although the amount of débris impacted in and around the teeth was found to vary among the five groups according to the percentage of sugar in the diet, there was also a difference within each group, depending on the de-

gree of attrition and fissure depth. Naturally enough, the older rats, which showed a complete wearing down of the molar cusps, showed also an absence of impaction of cereal particles on account of the shallow fissures thus produced.

In this series, the age of the animals was in almost every instance the determining factor in the degree of attrition of the molar teeth. It is believed that the greater degree of wear in the older rats was accountable for the larger number of enamel fractures occurring in these animals. As the age of the animal increases and the wearing down process continues, the obtuse angles on the margins of the molar teeth and their fissures give place to a more acute angle. Also, the protective enamel covering becomes thinner and weaker. Under these conditions, fracture is much more apt to occur.

Fracture of the enamel occurred to some extent in nearly all the rats in this series. In the great majority of cases, this appeared only as a chipping of the enamel edges, but, in a great number of instances, the fracture reached as far as the dentino-enamel junction, thus exposing the dentin surface.

The frequency with which particles of metal were found impacted in the fissures points to the possibility that these fractures were caused by trauma against the metal feed dishes or by particles of solder from the metal cages. Also, it is not impossible that some of the hard corn grit particles may have remained unchanged in spite of the method of preparation under steam pressure. Enamel fractures were found in all twelve molar teeth, but were most pronounced on the mesiobuccal cusps of the two lower second molars, on the mesial unprotected border of the lower first molars and along the posterior wall of the occlusal fissures.

Several factors in this investigation have been variously considered as conducive to dental decay in rats: (1) the forcible impaction of cereal and other food particles in the fissures and between the teeth; (2) fracture of the enamel and exposure in numerous instances of the dentin surface, and (3) the high sugar content of the diet fed in the form of a sticky adhesive mass. In spite of this fact, the incidence of dental caries, determined microscopically, was remarkably low, so low in fact as to be considered almost negligible.

Reference to the table shows that of the total of 213 rats in the one control and four test groups, only four, or 1.9 per cent, gave any evidence of tooth destruction; and of 3,408 teeth examined, only four, or 0.12 per cent, were affected. This total does not include the second generation rats, not one of which gave any evidence of interproximal, cusp or fissure caries. Furthermore, the experimental period was of considerable duration when considered in terms of the life cycle of the rat. It must be remembered too that the rat is by no means immune to dental caries. For example, Agnew[32] has reported the development of caries in seventy out of seventy-one rats fed a diet low in vitamin D and phosphorus for periods of from sixty to 210 days. Blackberg and Berke,[33] feeding 5-week-old rats a modified Steenbock and Black diet No. 2965, reported a 33.3 per cent incidence of caries in a rachitic group and 100 per cent incidence in a group receiving excess viosterol. Numerous other workers have reported a high incidence of caries in the rat under various experimental conditions, attributing the production of caries variously to the physical

32. Agnew, Mary C.; Agnew, R. G., and Tisdall, F. F.: Production and Prevention of Dental Caries, J.A.D.A., 20:193-212 (Feb.) 1933.

33. Blackberg, S. N., and Berke, J. D.: J. D. Res., 12:609 (Aug.) 1932.

nature of the diet, mineral or vitamin deficiencies or other conditions. Whether the explanations as to the etiology advanced by the investigators are correct, their results would at least seem to indicate that the rat under certain given conditions is highly susceptible to tooth destruction.

Whether this cavity formation or tooth destruction in the rat is identical to dental caries as we understand it in man would seem still to be open to question. In the human being, dental caries is essentially a disease of childhood and begins on the enamel surface. In this series, in the few cases that did occur, it was confined to the older animals. Moreover, of the four teeth affected, one, an upper second molar, was completely broken down to the gum margin; while the other three, all second lower molars, were at least 50 per cent destroyed. It is true that these four isolated cases showed definite softening of the dentin with every appearance of true decay. It is significant that, in almost every case throughout the series, it was the second molars, particularly the lower, which showed the greatest degree of trauma and fracture of the enamel. This fact would seem to point to trauma and consequent fracture as the primary cause of the destruction.

It is noteworthy also that there was no instance of decay in its early stages in any one of the 213 animals or 3,408 teeth examined, nor was there any evidence of gross hypoplasia or defective calcification in either the control or high-sugar groups.

In the control group, one carious tooth was found in fifty-seven rats; and, in the four test groups, three decayed teeth in 156 animals. Not only was the incidence of caries in the control group almost identical with that in the test animals, but the total number found was too small to have any real significance. It seems obvious, therefore, that contrary to the findings of some investigators, a high-sugar intake under the conditions outlined is not conducive to dental caries in the rat. The extent to which these results can be interpreted in terms of the human subject is open to question. Differences in intermediary metabolism, the chemical composition of the saliva, the bacterial flora of the mouth, the structure of the teeth and the resistance of the enamel surface are all factors which cannot be overlooked.

Clinical experience with children in orphanages would certainly lead one to believe that the most constant differential between these and the apparently more susceptible noninstitutionalized children is the amount of sugar and fine carbohydrates ingested. It has not been determined whether the sugar itself is the etiologic factor or the lack of balance brought about by the crowding out of more desirable dietary elements.

If it is true, as stated by Bunting,[34] that an increase in sugar intake will induce active caries in children even when they are receiving a diet otherwise nutritionally adequate, it would be of some interest and considerable importance to know just what factors are acting in the rat to confer this apparent immunity under similar conditions.

Microscopic examination of a large number of decalcified sections of the molar teeth from all groups as well as from the second generation rats yielded no evidence of structural changes as reported by Shibata. There was no evidence of enamel excrescences or imperfect calcification. The dentin in all cases appeared perfectly normal and no hyperemia, bleeding or atrophy of the pulp could be observed.

The periodontal tissues were carefully studied under the binocular microscope.

34. Bunting, R. W.: J. D. Res., 14:162 (June) 1934.

In no group was there any evidence of hyperemia of the oral mucous membrane, which Pickerill[35] says is known to follow the ingestion of large amounts of sugar.

SUMMARY AND CONCLUSIONS

Dental effects from the ingestion of excessive amounts of sugar were studied with many laboratory animals on high-sugar diets from an early age and for considerable lengths of time. More than 200 white rats were divided into five groups, one receiving the basal diet alone, the other four groups having, respectively, 20, 35, 55 and 55 per cent of sugar added to the basal diet. The last group received additions of 3.3 per cent of Osborne and Mendel's salt mixture, 3 drops of cod liver oil and 0.6 gm. of yeast per rat a day. The sugar source was a popular brand of chocolate fudge, melted and mixed into a sticky adhesive mass with a basal ration consisting of Purina Fox Chow. This diet was fed *ad libitum* for from 150 to 261 days, when the animals were examined postmortem and the teeth carefully examined under a binocular microscope.

Brown plaque formation was always present in direct proportion to the percentage of sugar in the ration, and much débris and impaction of corn particles occurred in the molar fissures. Numerous fractures occurred in all groups, in many cases with exposure of the dentin surface.

Of the total of 213 rats, only four, or 1.9 per cent, showed evidence of caries; and, of the 3,408 teeth examined, only four, or 0.12 per cent, were affected; and these were distributed so that there was almost an equal incidence in the control and test groups. A high-sugar intake would therefore not seem to be conducive to a high-caries incidence in the rat, even when the ration is fed in a highly sticky and adhesive state.

It is believed that sufficient of the well-balanced basal ration was consumed to ensure a sufficiency of minerals and vitamins even in the high-sugar groups receiving no supplements of these food factors, and that this was responsible for the almost complete immunity to dental decay in this series.

After 150 days, the animals in all groups were able to complete successfully the reproductive cycle, and there was no evidence of decay or defective tooth formation in the second generation.

Many decalcified sections were examined for evidence of the phenomena reported by Shibata. There was no abnormality in development of enamel cells or dentin and no bleeding or atrophy of pulp.

The periodontal condition remained normal in all groups.

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35. Pickerill, H. P.: Stomatology in Dental Practice, Ed. 2, London: Henry Kimpton, 1926, p. 86.

A SIMPLIFIED, IMPROVED FULL DENTURE TECHNIC*

By WILFRID H. TERRELL, D.D.S., Pasadena, Calif.

SIMPLIFICATION is of no advantage unless it carries with it improvement, and, as happens with all development, there first comes improvement, which is followed by simplification. I am going to present, necessarily in a summarized form, a complete sequence for full denture construction which is not difficult to follow out and which incorporates precision in each procedure. It incorporates several new features which have been thoroughly tested, but which have not heretofore been presented. There is an oft-repeated saying, that "a chain is only as strong as its weakest link" and the attempt has here been made to strengthen a few of the weaker links in full denture construction, but the ultimate result is dependent equally on the precision and on the accuracy with which each step of the work is carried out by the operator. I shall confine this paper as nearly as possible to the practical side of the question, omitting as much as possible of the technical and theoretical parts.

The following is a summary of the appointments with the patient and the laboratory procedure which is completed between appointments.

APPOINTMENTS WITH THE PATIENT

1. Examination, consultation, prognosis and decision as to fee and method of payment.

2. Primary impressions and the selection of the teeth.

3. A study in esthetics, determining the vertical opening and trying in the anterior teeth.

4. Muscle trimming and postdamming the bases and securing definite functional positions.

5. Trying in the teeth set up in wax.

6. Delivery of the finished dentures and instructions to the patient.

LABORATORY PROCEDURE

1. Pouring primary casts, vulcanizing impression bases, attaching wax relationship rims and setting up anterior teeth.

2. Making temporary mounting in centric relation to preserve the vertical opening while attaching the relationship recorder.

3. Removing wax rims with anterior teeth and attaching compound rims and relationship recorder.

4. Pouring casts, mounting by Needles' split cast method on the coordinator and setting to duplicate mandibular positions.

5. Setting up teeth to centric, buccal, lingual and protrusive balance.

6. Vulcanizing, milling and recarving the occlusal surfaces and finishing the dentures.

(In this technic, any relationship method may be substituted for the relationship recorder and any articulator for the coordinator, but the results will vary according to their accuracy and adaptability.)

1. *Examination, Consultation, Prognosis and Decision as to Fee and Method*

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

Diagnosis and Record Chart

by

PASADENA PROSTHETIC STUDY CLUB

Patient _____ Date _____

Address _____ Phone _____

Recommended by _____

Radiographs _____ Study Models _____

TOOTH SELECTION

Color of: Eyes, Hair, Complexion, Teeth

Physical Size of Arches: 1. Large 2. Medium 3. Small — U, L

Face Form: 1. Square 2. Tapering 3. Ovoid

Arch Form: 1. Square 2. Tapering 3. Ovoid — U, L

Shade of Teeth Selected: No. _____

Mould of Teeth Selected: Anteriors No. _____ Posteriors No. _____

HEALTH AND SURGERY

General Health: Robust, Average, Frail

Age: Young, Middle Aged, Old

Teeth to be Extracted: R 8 7 6 5 4 3 2 1 | 1 2 3 4 5 6 7 8 L; L 8 7 6 5 4 3 2 1 | 1 2 3 4 5 6 7 8 — Date of Last Extractions: U. _____ L. _____

Surgery Necessary: U. _____ L. _____

DENTURE HISTORY

Kind of Former Dentures: U. _____ L. _____

Years and Kind of Service: U. _____ L. _____

Deficiencies of Dentures: U. _____ L. _____

DISCUSSION AND AGREEMENT

CLASSIFICATION CHART

Mental Classification: 1. Philosophical 2. Exacting 3. Hysterical 4. Indifferent

Muscular Tone and Development: 1. No Degenerative Changes 2. Normal Functions Preserved by Dentures 3. Subnormal Conditions

Physical Form of Alveolar Ridges: 1. Favorable. 2. Minor Difficulties 3. Surgery Needed — U. _____ L. _____

Soft Tissues: 1. Normal Density 2. Thin Membrane 3. Double Thickness 4. Surgery Indicated — U. _____ L. _____

Border Tissues: 1. Attached 2. Areolar (Placeable) — H. High M. Medium L. Low — U. _____ L. _____

Muscle and Frenum Attachments: 1. High 2. Medium 3. Low — U. _____ L. _____

Ridge Relation: 1. Normal 2. End to End 3. Protrusive 4. Retrusive

Throat Form: 1. Class I 2. Class II 3. Class III — U, L

Vault Form: 1. Square 2. Tapering 3. Arched 4. Flat

Tongue Form: 1. Wide 2. Medium 3. Narrow

Resorption of Tissue: 1. Normal 2. Incomplete 3. Excessive

Muscles of Mastication: 1. Heavy 2. Medium 3. Light

Health of Mucosa: 1. Healthy 2. Irritated 3. Pathological

Saliva: 1. Natural 2. Insufficient 3. Excessive — a. Serous b. Mucous

Fig. 1.—Diagnosis and record chart.

of Payment.—These six appointments are arranged not only to the best advantage for the operator, but also in consideration of the fact that we are not working on a manikin, but on a sensitive human being who has a keen mind and a layman's point of view, and we must conduct the case to the best advantage, to gain his interest, confidence and cooperation. These last three factors are indispensable to success, no matter how carefully we do our work. As a guide to a thorough examination and consultation, we follow a chart (Fig. 1) which was prepared for the Pasadena Prosthetic

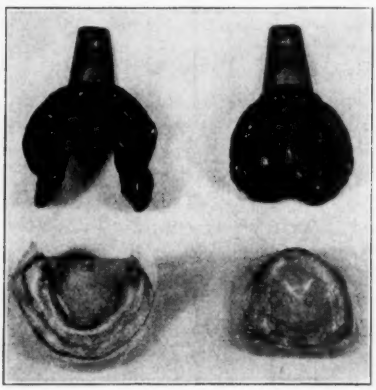


Fig. 2.—Primary impressions and resulting casts.

Study Club. We are liable to overlook important factors if we do not have a guide.

A prognosis should be given at this time, and the operator must be certain that the expectations of the patient are well within his own ability to meet them. Otherwise, it is better not to take the case, for the dentist's time will be wasted and his reputation jeopardized; to say nothing of the expense and worry. This is also the time to state the fee and make definite arrangements for payment. The patient may or may not mention it, but this subject must be discussed, whether we like to talk about money or not. There will never be a more auspicious time.

2. *Primary Impressions and the Selection of the Teeth.*—One of the things that patients are most interested in is seeing how the teeth are going to look. They are not so much interested in technical procedures, but we must develop their interest to the point where we get their fullest cooperation at the time when the

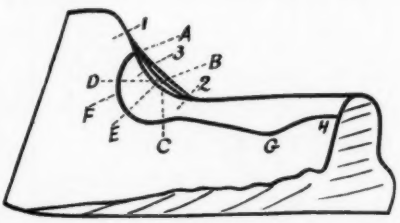


Fig. 3.—Lateral throat form.

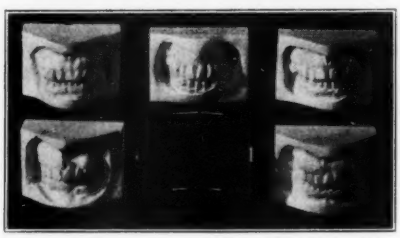


Fig. 4.—Form developed by E. Leslie Eames for making casts to study natural esthetics.

most accurate and painstaking work must be done. The sooner the teeth are selected, the more time we have to reconsider our decision and be certain that we are right and that the patient is in accord with our plans. Advancement in denture work to the majority of patients means easier methods of taking impressions. Most patients will cooperate 100 per cent when they have full confidence, and we must build this as we go. The pri-

mary impressions do not take long, and the patient is happy about the first working appointment, for the teeth have been selected and impressions have been taken. To most of them, this is the most important part of denture work, but they soon learn that there are other important steps, and they must be willing to cooperate to the fullest extent. They begin to realize that denture work has advanced and that all artificial teeth are not alike. They also realize that it is to their advantage to cooperate with the dentist to accomplish the result he is working for. When we attain this point, our work becomes easy, for we can concentrate on the details rather than on the patient's attitude of mind. It is here that denture work becomes a pleasure and the way is paved for success.

What we desire in the primary impression (Fig. 2) is a modeling compound impression which evenly compresses the tissues and is overextended, that we may outline on the model, by the anatomic landmarks, the borders of the impression base. The throat form (Fig. 3) should be classified, and if it is a Class I or II according to Neils' classification, extensions should be added to the impression, carrying it distally into the lateral throat form area. It is a mistake not to take advantage of this aid to stability for the lower denture, and if there is room for it, it will be perfectly comfortable to the patient and will not cause soreness or discomfort unless overextended.

Condemnation can come only from misapplication of the principle; for, in our own practice alone, it has been successfully used for the past seven years. It is best to use the black compound for the lower impression. The upper is taken with red compound, so that the outline of the hard area and the distal border can be marked in the mouth and transferred to the impression. Before the upper impression is poured, the hard areas are relieved and the line joining the hamular notches and the palatal fovea is grooved so that it will be transferred to the cast. The purpose of these primary

Fig. 5.—Left: Appearance of patient after resorption had taken place. Right: Appearance of patient after restoration of lost dimensions. Restoration had been made four times.

impressions is to construct vulcanite impression bases, as they may be called. They will be muscle trimmed and postdammed and used as rigid functional bases upon which to take the ridge relations.

The first working appointment is the best time to make the tooth selection. This gives us the maximum time for reconsidering our decision and the anterior teeth are available at the time we determine the vertical opening on the wax rims. This is a very important point and its advantage should not be overlooked.

Much has been written on tooth selection, and from the appearance of most dentures, there is much yet to be learned. Every dentist is familiar with the general rules to be used as guides as to size, form and shade. These are like the multiplication tables: you need to know them, but you have to apply them to get the answer. Knowing the tables does not necessarily mean that you will get the correct answer. The greatest aid to tooth selection (Fig. 4) is the study and classification of patients who have their own teeth. Judgment in tooth selection becomes an art, the growth and development of which is dependent on concentration and study. Shaping of the anterior teeth and tooth arrangement come under this same classification. There is probably no place in dentistry where art plays so important a part as in full denture work, and forming the habit of studying patients with natural teeth develops the judgment.

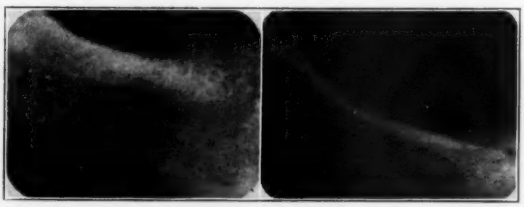


Fig. 6.—Films taken in 1928 (left) and 1934, showing resorption of mandible under lower denture.

Fig. 7.—Three dentures made in succession because of resorption of the mandible.

Fig. 8.—Notch cut in denture to receive ball of soft wax.

3. *A Study in Esthetics, Determining the Vertical Opening and Trying in Anterior Teeth.*—Figure 5 shows the effect of the settling of dentures, principally the lower denture, over a period of five years. This change is taking place to a greater or less extent under

all full dentures, and we should have the concept that we are working on ever-changing bases. Roentgenograms (Fig. 6) taken at the time that the two dentures were made show very clearly the absorption which has taken place in this mandible. This is one of the most important reasons that a set of full dentures made to replace the natural teeth should not be considered the permanent denture solution for that patient. If esthetics and function are to be kept normal, succeeding dentures will have to be made or corrections made to overcome these changes as they become apparent. This period will vary with each patient and also in

Fig. 9.—Rims mounted on plain line articulator.

an inverse ratio to the length of time that dentures have been worn. Figure 7 shows three succeeding dentures which have been made for a patient, and he is now wearing a fourth.

The vulcanite impression bases with wax rims attached (Fig. 8) are taken to the mouth and the high and low lip line and median lines marked, and the horizontal plane is established. The anterior teeth are now attached to both upper and lower rims and arranged in the best esthetic positions. The anterior "try-in" at this time is an invaluable aid in determining the vertical opening required for each patient. It should always be used in establishing the vertical opening, as it is practically impossible to determine anything but the closed mouth effect with a pair of red wax bite-blocks.

A notch is cut (Fig. 9) in the first molar area on each side above and below, and the sections are slightly lubricated. A small ball of soft wax is placed in the notch on either side and the patient is asked to "close" in as nearly centric position as possible. The impression bases are then mounted on any articulator which has a vertical stop.

The wax rims with the anterior teeth are then removed from the impression bases and set aside. Compound rims are attached to the upper and lower bases and the upper and lower checkbite plates (Fig. 10) are attached to these with the vertical opening on the center ball set exactly as had been determined in the mouth with the wax rims.

The lower checkbite plate is temporarily removed from the compound rim of the lower base while the lingual muscle trimming is being done.

4. *Muscle Trimming, Postdamming and Securing Definite Functional Positions.*—A Green tracing stick is used around the entire peripheral border of the upper impression base (Fig. 11), including the postdam area. It is flamed to make it plastic, dipped in warm water and pressed firmly to position. Muscle trimming is carried out in sections from molar to cuspid and cuspid to cuspid. The postdamming is completed and tested.

A Green tracing stick is employed around the entire periphery of the lower impression base with the exception of the throat form flanges; flamed, dipped in warm water and seated firmly. Muscle trimming is done in sections on the buccal, labial and lingual aspects. Compound is traced on one throat form flange and

seated firmly. The patient is instructed to go through all functional movements of yawning, protruding the tongue and swallowing. The opposite side is carried out in a like manner. It is now tested for retention.

Lastly, the lower checkbite plate is reattached so that the pressure may be equalized under biting stress and the impressions are warmed slightly before the patient is asked to close firmly, suck and swallow. This will establish the maximum retention in both cases under functioning conditions.

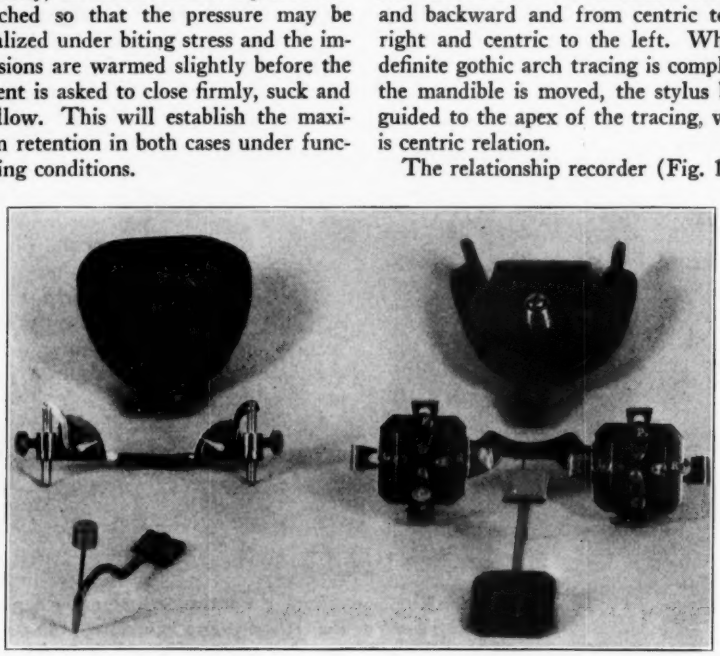


Fig. 10.—Parts of relationship recorder and Stansbery checkbite appliance.

One of the zinc oxide impression materials is now mixed to proper consistency and applied to both the upper and the lower ridges. They are placed in the patient's mouth and the patient is instructed to close and hold under firm pressure. The vertical stop serves to equalize the pressure on the upper and lower ridges while the impression material sets.

The relationship recorder is assembled (Fig. 12) with the Stansbery checkbite appliance and the vertical pins of the recorder are lifted and locked. The graph plate of the checkbite appliance is smoked by dipping a pellet of cotton in eugenol and passing it over a flame. The stylus is placed in position and the patient instructed to move the mandible forward and backward and from centric to the right and centric to the left. When a definite gothic arch tracing is completed, the mandible is moved, the stylus being guided to the apex of the tracing, which is centric relation.

The relationship recorder (Fig. 13) is an instrument which has been designed to transfer accurately the maxillomandibular relations in centric, right and left lateral and protrusive positions, from the mouth to the articulator. Our purpose in developing this instrument was to eliminate the objectionable features connected with the use of plaster, compound and wax. As you see in Figure 13, there are very definite sharp, accurate points which are adjustable in position and can be locked securely to the four positions

of centric, protrusive, right and left lateral relations. These positions are marked on the instrument by the initial letters. The upper half of the recorder (Fig. 14) consists of two calibrated dials on which are recorded the variations in vertical opening. The movement within the mouth is accurately transferred to the recording dial, so that it will actually record tissue compression. The vertical pins of the upper member are drilled to fit over the positioning points on the lower member of the instrument. For setting the articulator, these pins can be locked to the positions recorded on the dials at the time the relationship was taken in the mouth (Fig. 15). The three points which

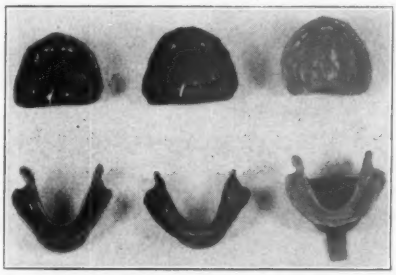


Fig. 11.—Steps in upper and lower impression taking.

stabilize the relationship are in the form of a tripod (Fig. 16), two legs being the two points of contact between the upper and lower parts of the relationship recorder and the third the vertical stop or center ball between checkbite plates. The center ball is used only as a vertical stop and not as a pressure equalizer except in centric relation, for, in the lateral and protrusive positions, it moves away from the center of the upper plate. It does remain always in the center of the lower plate as it is attached to it.

Three pressure cushions have been made (Fig. 17) which are attached to the three points projecting from the under surface of the upper checkbite plate. The two metal studs are permanently removed from the lower to prevent interference with the pressure cushions attached to the upper. These cushions equalize the pressure in lateral and protrusive positions and give the effect of biting on a bolus of food. The purpose now of the center ball is to serve only as a vertical stop. It should be adjusted to the cusp rise of the posterior teeth to be used in that particular case before the lateral relationship is taken and to the overbite as set for esthetics before the protrusive relationship is taken. The pressure cushions are used only in the mouth for securing lateral and protrusive positions, but not for centric, as the ball is in the center of both upper and lower plates in centric position.

The vertical pins are dropped to the centric points, which are in turn locked in position. The vertical variations are recorded from the dials. The lower is removed from the patient's mouth and the vertical stop raised to the height of the cusp rise of the posterior teeth to be used, and a tracing is made at this height. The three pressure cushions are attached to their studs and the mandible is moved laterally, the stylus being brought laterally along the gothic arch to the point that will bring the posterior teeth from centric relation to their lateral working position when the teeth are set up. The distance required can accurately be measured. Here the patient should exert sufficient pressure on the pressure cushions that the vertical stop just makes a contact. The relationship recorder is now locked and the vertical distance on the pins recorded. The opposite lateral position is taken in the same way. The vertical stop is now raised the amount necessary to clear the anterior teeth in the protrusive position and the protrusive relationship recorded.

Figure 18 shows the relationship transferred to the new precision coordinator. The coordinator combines the features of an anatomic articulator, a spherical articulator, a tripod and a plain line instrument.

A list of the movement and position controls follows:

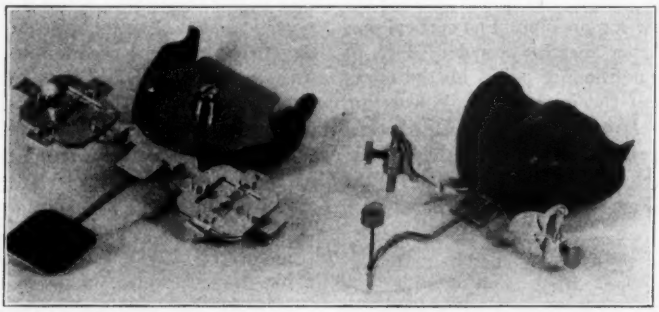


Fig. 12.—Relationship recorder assembled with Stansbery checkbite appliance.

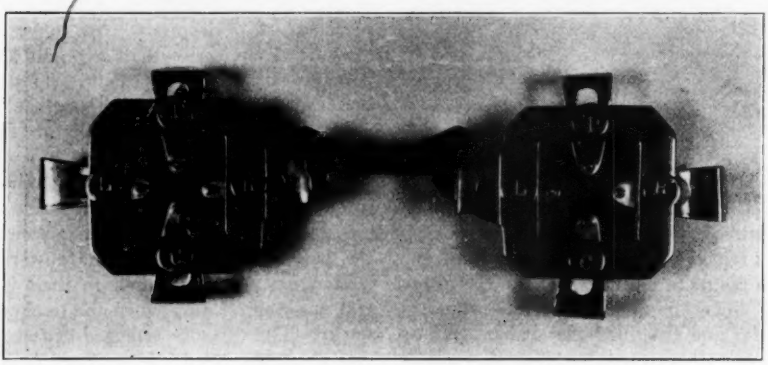


Fig. 13.—Positioning pins on lower member of precision relationship recorder.

1. Sagittal condyle path or condylar inclination.
2. Lateral condyle path or lateral shift.
3. Condylar inclination constant with opening incident introduced.
4. Lateral movement or positions controlled to the patient's lateral gothic arch path, which serves as a rotation center control.
5. Spherical movement control or vertical shift.
6. Protrusive incisal guide.
7. Lateral wing guidance or cuspid guide graduating from flat to convex.
8. Precision calibrations.
9. Calibrated vertical incisal opening.
10. Curved incisal pin, tangent to the arc of opening.
11. Plain line adjustment.
12. Adjustable milling machine built into the base.

Figures 19-23 are the various views of the instrument.

The casts are poured, and before they are mounted on the coordinator, they are tapered toward the bases and the bases are grooved (Fig. 24). They are oiled with cocoanut oil and mounted on the precision coordinator. The upper mounting is loosened from the upper arm of the coordinator, and the instrument is accurately set by means of the records taken. Baseplates are adapted to the casts, wax rims attached and the teeth set up and accurately balanced.

5. *Trying in the Teeth Set Up in Wax.*—This is an important appointment with the patient and a serious one for the operator if any errors are made. The patient should be made to accept the responsibility for absolute approval. If all doubts have not been removed from his mind, for our own protection as well as for his satisfaction, we should insist on another appointment and have some critical friend or relative present.

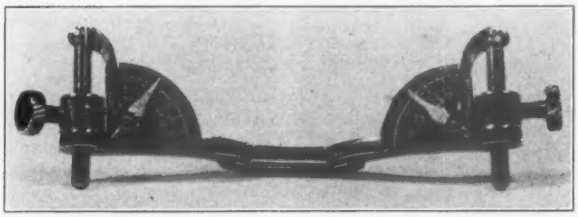


Fig. 14.—Vertical pins and recording dials of precision relationship recorder.

Fig. 15.—Recording maxillomandibular relations.

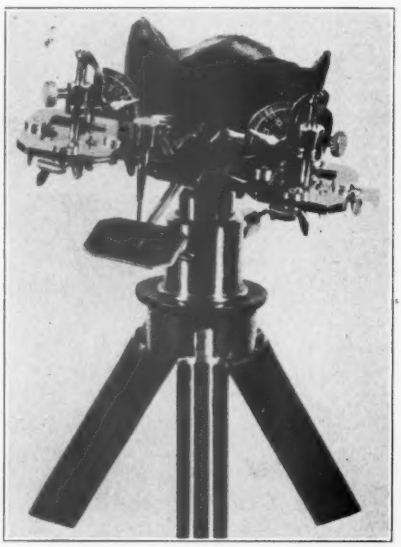


Fig. 16.—Precision relationship recorder mounted on tripod to illustrate three point principle of stability.

If we have done our work properly and if the patient has full confidence in us, this will not be necessary, for it will be left to the dentist.

Fig. 17.—Pressure cushions used to equalize pressure on upper checkbite plate.

The casts are each separated from their mountings and the bases tinfoiled (Fig. 25) with 0.001 foil to prevent the flasking plaster from adhering to the grooved bases. These casts should be made from one of the quick setting, hard stones which do not disintegrate in the vulcanizer. After vulcanization, they are removed from the flasks and the tin foil is removed. They are attached to the other halves of their split casts on the coordinator by luting with plaster. The interfering points are located with carbon paper and corrected with small stones until the incisal pin is again touching in all positions. The cusps are preserved and interference is eliminated as nearly as possible from the opposing porcelain.

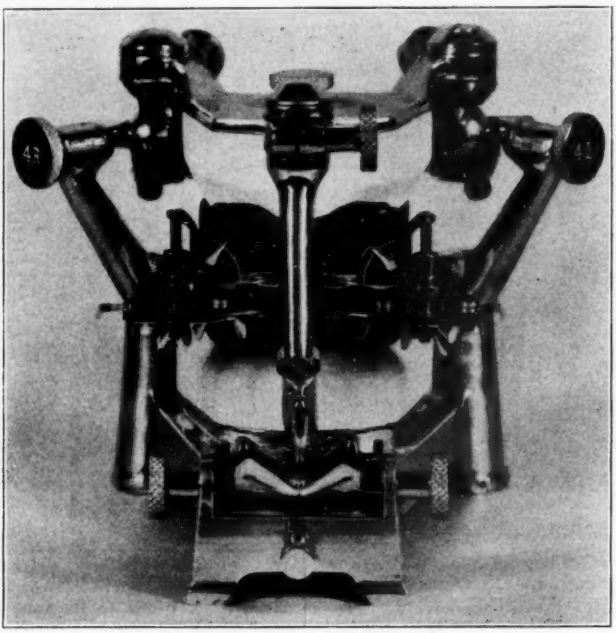


Fig. 18.—Two new instruments: precision relationship recorder and precision coordinator. (Designed by author.)

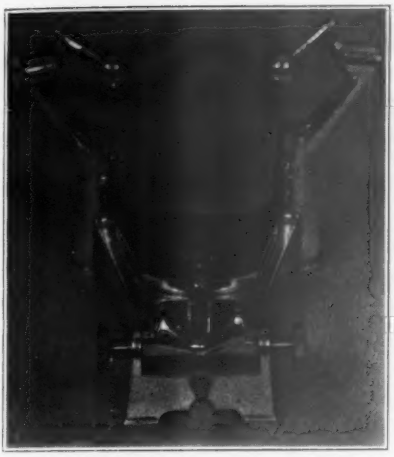


Fig. 19.—Condyles set, showing vertical shift adjustments.

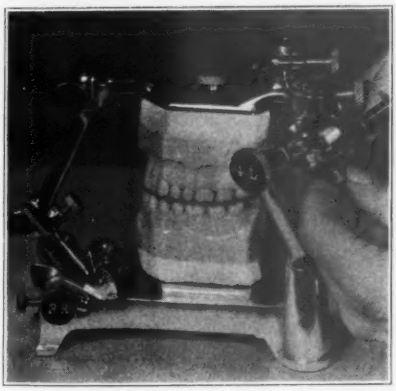


Fig. 20.—Adjustable condyle path in which condyle head of instrument is controlled. *A*, calibrations for protrusive incisal path. *B*, 3 R locking screw for cam which controls right lateral gothic arch path.

Fig. 21.—Lock screw for locking grinder previous to mounting. *A*, grinder pulley; *B*, screw adjustment for protrusive incisal path; *C*, screws for elevating and lowering right and left guides for cusp elevation. *D*, screws for setting lateral protrusive path.

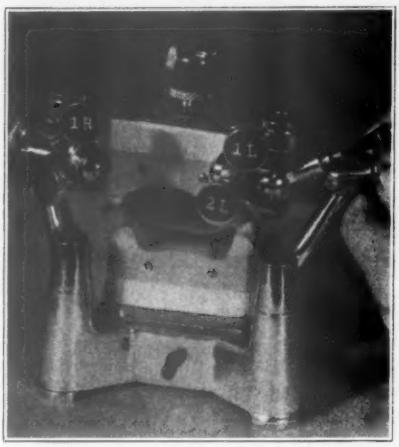


Fig. 22.—Vertical shift adjustment.

The occlusion is freed with the rotary grinder (Fig. 26), milling paste or some abrasive compound first being placed on the occlusal surfaces of the teeth. The incisal pin is kept in position so that over-milling or a change in vertical opening is impossible. Milling does two things:

1. It increases the space between por-

celain contacts and provides better scapeways for the food as it is crushed between the contacting porcelain surfaces. It does not decrease the number of porcelain contacts, but it does decrease the number of surfaces in contact at any one time, thus decreasing the force necessary for mastication.

2. It provides a freer movement to the masticating surfaces of the dentures, which decreases the trauma to the supporting mucosa and gives increased comfort to the patient.

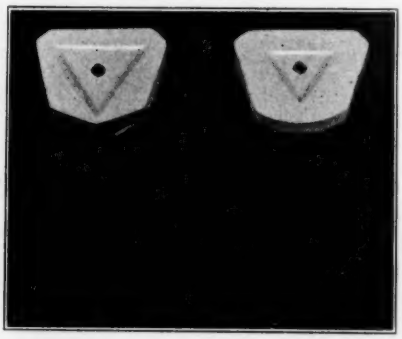


Fig. 23.—Convenient means for mounting casts on precision coordinator.

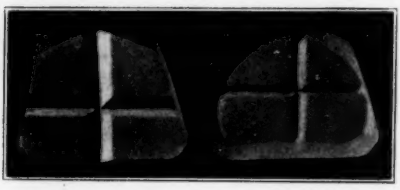


Fig. 24.—Casts used in Needles' split cast method of mounting.

With small stones running in oil (Fig. 27) and kept sharp with a diamond truing instrument, the cusps are all sharpened and the grooves between all the cusps are deepened and opened out to the buccal and lingual aspects. Supplemental grooves are carved on either side of the crests of the ridges, running from the tips of the cusps to the centers of the teeth. This provides only line and point contacts for cutting and leaves no flat mashing surfaces, thereby decreasing the force necessary for mastication. (The 133 deep bite mold which was carved by M. M. House is one of the best forms that we have for this purpose.)

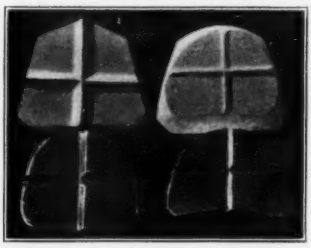


Fig. 25.—Casts split and foiled before flasking.

Fig. 26.—Lathe attached to milling machine built in base of precision coordinator.

Fig. 27.—Equipment necessary for recarving porcelain teeth.

Why don't we give our patients sharp, efficient teeth instead of flat, dull surfaces? Denture efficiency can be greatly increased, and should be, by recarving the porcelain surfaces. After recarving, they should be polished with burlew disks followed with pumice and then tin oxide. It is important that artificial teeth be even sharper than natural teeth, but we very seldom see this.

6. *Delivery of the Finished Dentures and Instructions to the Patient.*—The wise dentist warns his patients ahead of time as to what they are going to experience, and he should explain to them the reasons. It is far better to do this explaining in advance for, coming later, it seems more as an excuse to the patient. We ourselves know the limitations that they are going to encounter, and these should have been reemphasized from time to time as the work was carried on.

New dentures should never be subjected to extremes of pressure until they have been in a sufficient length of time for the tissues to build up a resistance to stress within the new forms. They should be told to let comfort be their guide as to the amount of stress to be applied. The amount of stress which can be applied increases with time, and no patient should be allowed to become discouraged in the beginning by failure to explain this.

The patient should be instructed not to remove the dentures at any time except for cleaning, and to replace them as soon as possible. The dentures maintain the facial expression and keep the muscles of mastication, the joints and related structures in definite relations, and if the dentures are left out overnight, these structures are operating under abnormal conditions approximately one third of the time. An appointment should be given the patient the following day to check up on the soft tissue conditions. If the work has been properly done, there will be little if any relieving necessary, and the occlusal surfaces of the teeth will never need to be touched. The teeth will be in balance in all positions and the patient will not experience the discomfort as well as trauma and soreness which result if there is cusp interference.

Time spent in following a precision technic will be more than paid for in the time saved from adjustment and possible remaking of the denture, and in the increased satisfaction to the patient, which is the surest practice builder.

SILICATE CEMENTS—THEIR USE AND THEIR ABUSE*

By MALVERN DUMAH HUFF, A.B., D.D.S., F.A.C.D., Atlanta, Ga.

THE most valuable and scientific contribution to our literature on the subject of silicious cements is that read at the Seventy-Fifth Annual Session of the American Dental Association by K. W. Ray, Ph.D., who opens his paper with this remarkable statement:

If plastic silicate cement fillings and restorations were entirely satisfactory from the standpoint of permanency and utilitarian value, they would be almost the ideal filling material. Clinical experience has shown that they are far from satisfactory

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

when compared to the ideal. Silicious cements shrink while setting and are not entirely insoluble in the oral fluids, and their adaptability to the walls of cavities leaves much to be desired. Furthermore, in many cases, especially in the past, the use of silicate cements as fillings has caused the death of the pulp of the tooth.[1]

The foregoing excerpt contains, first, that very important word "if," and properly so, and four criticisms follow which indicate the failure of this material to measure up to the ideal; namely, regarding shrinkage while setting, solubility in oral fluids, lack of perfect adaptability to walls of cavities, and, last, responsibility for death of the pulp of the tooth. Any one of these indictments would, if true, exclude this material from the ideal, and they are true, in my opinion. In a paper read before this section in Detroit in 1927, I said: "Many dentists are digging their professional graves with a glass slab and an agate spatula."[2] Yet we find that some of us are spreading this material from ear to ear. Silicious cements shrink on setting, and we cannot prevent it. This shrinkage is in proportion to size, and thus large fillings cannot stand, because saliva, bacteria and subsequent decay occupy the space occasioned by this inevitable shrinkage; and if it were possible to control this on setting, it has been shown that much shrinkage takes place at any time that silicates are dried out, as in the case of mouth breathers.

The statement that silicious cements are not entirely insoluble in the oral fluids has been proved true in the experience of all who have used this material for any length of time, although it should be observed that the degree of solubility is quite variable in different mouths. We might also observe here that when approximal cavities begin to be disintegrated by the saliva, food packs begin to appear. The use of the toothpick, in private, accelerates the process and we have the natural result of migration of the teeth, bringing about gum pinches and resultant periodontoclasia, and loss of anatomic form in restorations when repair is undertaken. If there were no other reasons for limiting the use of silicious cements than these, we would be justified in taking a stand against its indiscriminate use.

The third shortcoming refers to the adaptability of the cement to the walls of the cavity, and those who are the most ardent advocates of this material claim this as its greatest asset, without realizing that while it is being held in position and is setting, it is shrinking away from the cavity walls and does not adhere in the least to the walls against which it is being pressed, and, at that instant, free silicic acid is being pressed into the dentinal tubules; which will cause future trouble in the form of irritated and devitalized pulps.

This brings us to the consideration of the fourth shortcoming brought out in the quotation above, namely, death of the pulps of teeth.

I am well aware of the fact that though loss of the pulp is sometimes discovered under silicate fillings, the condition was present when the filling was placed, and thus it is manifestly unfair to charge the death of such a pulp to the use of this material. On the other hand, I have seen under such fillings many devitalized pulps which were known to be vital at the time of insertion of the filling.

We had occasion to suspect that this material was irritating to the pulps of teeth soon after it was introduced and made popular many years ago, and a

1. Ray, K. W.: Behavior of Silicious Cements, J.A.D.A., 21:237 (Feb.) 1934.

2. Huff, M. D.: Porcelain Inlays and Their Substitutes, J.A.D.A., 15:1505 (Aug.) 1928.

study club, of which I was a member, took occasion to analyze one of the first "enamels" to appear. Our chemist found traces of arsenic in it, and later we found that the "improved enamel" did not contain traces of arsenic. There are other ingredients in silicious cements which have been found irritating to the pulps of teeth as, for instance, the free silicic acid above referred to. Then, too, it seems that this material does not prevent shock from thermal changes.

The assertion that pulps are sometimes killed by the invasion of bacteria forced into the pulp through dentinal tubules by pressure produced by the strip when a silicate filling is placed should not be held against the material, because the cavity should be sterilized thoroughly before this is done. Anyone who has used this material for any length of time has had patients return complaining of sensitiveness of the teeth thus filled, when the cavities were comparatively shallow and the sensitiveness could not be satisfactorily accounted for.

A CASE IN POINT

Mrs. K. came in for relief after about three weeks of pain caused by the presence of a shallow cervical inlay in a lower left first bicuspid and one in a lower right first bicuspid, both having been set with some kind of silicious cement. She gave a history of having suffered pain from the time the fillings were placed, a pain steadily growing in intensity. She called her dentist three days later and he assured her that all would be well and that this sensitiveness was not unusual and would pass. The pain increased in intensity until the patient required internal remedies for relief. She finally had to use cotton between the upper and lower teeth to prevent pain on closing. When she was first seen, I suspected death of both pulps. The inlays were removed and guttapercha placed in each cavity and the patient was dismissed for four days. On her returning and reporting no pain, the same inlays were reset with oxyphosphate cement. They have remained comfortable since that date, Oct. 12, 1933. June 23, 1934, the teeth were tested for vitality and found normal. When first seen, they were unquestionably in a precarious condition. It took twelve or thirteen points on the electric pulp tester to get any response when the inlays set with silicate were removed. Today, they respond to points five and six.

The fact that these inlays were so easily dislodged that the porcelain margin remained perfect is another very valid reason for condemning silicate cement for this purpose. This material does not possess sufficient adhesive qualities to justify its use in this connection.

CAUSE OF SENSITIVENESS

Some of our investigators recently have come to the conclusion that silicic acid, which is formed when the powder and the liquid are mixed, causes the pulp irritation; while others assert that a certain amount of hydrofluoric acid is generated and it causes irritation. Whatever it may be, we are not justified in placing this material in vital teeth without thoroughly protecting the pulp by phosphate cement in deep seated cavities and with varnish in the shallow cavities.

LIMITED USES

Silicate cements should be restricted to small pits and fissures and small proximal cavities in the anterior teeth and, when they are employed in proximal cavities, the natural enamel contact point should be preserved when possible and "extension for prevention" should not be resorted to because the natural enamel will resist decay longer than the average silicate filling will last. When it is necessary to make a more extensive restoration, baked porcelain should be used to maintain anatomic form.

Silicious cements have no place in

cervical cavities that are situated at the gingival border or under it. They very soon cause irritation at the gum margin, and I have never seen a healthy gum margin in contact with a silicate filling that had been in place for as long as a year. Silicates serve a good purpose as temporary crowns when porcelain packets are made and sometimes for filling in anterior portions of gold inlays to prevent the display of gold. In many of these cases, all porcelain inlays will serve to assure a better restoration.

COMPOSITION AND PROPERTIES OF CEMENTS

The exact composition of the various silicious cements is a trade secret. Crowell and other investigators have determined that:

Silicate cements differ from zinc phosphates, chiefly in the composition of the powder. The liquids are solutions of phosphoric acid partially neutralized with zinc and alumina, differing from the zinc cements only in the amount of water contained. The powders are complex acid soluble glasses containing alumina, silica, calcium, potassium and sodium, in the form of oxides.

These materials are mixed as cements are. They are placed in the cavities just as cements are; and the point I am making is just this: we are not justified in referring to them as porcelain fillings. It is not fair to the public we serve and it is manifestly unfair to our confrères who take the additional time and skill to make a real porcelain restoration. The silicious cements are so similar to the oxyphosphate cements and so very different from porcelain that they should not be considered in the same class, much less be called by the same name. We have known for a long time that phosphate cements can have the setting time doubled or more than doubled by a partial neutralization of the liquid with a very small amount of the powder, drawn into it and thoroughly mixed with it, the mixture being left alone for a minute and the mixing then completed.

The manufacturers of silicious cements add zinc oxide or alumina, or both, to the liquid before distribution in order that the setting time may be sufficiently long to permit proper placing of the material in the cavity. When we consider the uncontrolled and uncontrollable variables which affect the quality of silicious cements, it is no wonder that there is such a wide difference of opinion regarding results from the use of these fillings. It has been shown that room temperature, slab temperature, humidity or its absence, the rate of mixing and the amount of powder incorporated affect silicious cements. "The more water present in the liquid, the faster the set and the more it contracts; while the less water content, the slower the set and the more it expands."[1]

When we think of all these variables and their affect, we doubt that any two silicate fillings have ever been identical. We have reason to believe that, in a short time, proper specifications and a standardized technic will be found for all cements by the cooperation of the profession and of the manufacturers with the Bureau of Standards.

It is interesting to note that some of our operators incorporate four times as much powder into a given amount of liquid as other operators in different sections of the country and under different circumstances, when experimenting with phosphate cements. Is it any wonder, then, that we get such varied results with silicates, which are much more exacting in requirements and more rapid in mixing and in setting?

ESTHETICS

Silicate cements are used so generally

by dentists seeking the esthetic effect, and an esthetic effect is assuredly to be sought. Porcelain gives this effect and is decidedly more lasting; therefore, silicious cements should be declared in a state of obsolescence, which has been defined by Mr. Owen D. Young as that deterioration which takes place in a thing, not because it is not so good as it always was, but because there is something better.

CONCLUSIONS

1. Silicious cements fall far short of the ideal filling material, in that they shrink on setting, they are not insoluble in oral fluids, they are not perfectly adaptable to walls of cavities on account of shrinkage and they produce pulp irritation and finally devitalization.

2. Silicious cements should not be used for cementing porcelain inlays, on account of (1) lack of adhesion and (2) irritation.

3. This material should be limited in use to small cavities in vital teeth and used then only after the lining of cavities with varnish, and for a few other purposes.

4. Silicates are so similar to oxyphosphates that they should not be referred to as porcelain fillings.

5. So many difficulties and unsatisfactory results are encountered by operators, it is recommended that proper specifications and a standardized technic be determined by the cooperation of the members of the profession, the manufacturers and the United States Bureau of Standards.

1204 Medical Arts Building.

ANESTHETICS AND THEIR SIDE ACTIONS IN ORAL CONDITIONS*

By B. H. HARMS, D.D.S., Omaha, Nebr.

THE basic principle[1] of this the fourth, or physiologic, era of surgery is the conservation of the natural resistance of the patient, turning him over to his phagocytes and antibodies as quickly as we can do so—with a period of brief anesthesia and the least degree of surgical battle that will suffice.

In observing this basic principle, the profession has largely ignored the rôle of the anesthetic; that is to say, the anesthetic is largely used as the means to an end rather than an end in itself. And, in justification of this action, the profession has been literally swamped with literature forgetting this basic principle, to say nothing of the thousands of unpublished alibis that are made to the patient by word of mouth.

Therefore, the question is: Does the anesthetic play a part in this physiologic era of surgery? Is it an important part and how?

I hope to show that it does and it is, and how.

Dentists and surgeons, with few exceptions,[2] have converged their activities al-

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

1. Morris, R. J.: Principles of Fourth Era in Surgery, Am. J. Surg., 2:51-53 (Jan.) 1927.

2. Labat, Gaston: Anesthesia—the Predominant Element in Surgery, Anes. & Anal., 4:29 (Feb.) 1925.

most entirely on the operative procedure. They study the ways and means of achieving success by the eradication of pathologic conditions regardless of the effects of anesthesia, and the question of anesthesia becomes merely a side issue. Their interest is largely in completing the operation and in what happens to the patient at that time. They are not particularly disturbed about what occurs a few hours or a few days later or a possible stormy convalescence. The rôle played by the anesthetic is of no clinical significance to them; the main object of their operative procedure being to eliminate the pathologic condition that has brought the patient to them.

The elimination of the pathologic process has developed along lines of high art, which leaves the patient himself out as an unimportant and small object in the presence of the more important condition. The fact that many patients have a stormy convalescence following such operations is of less interest than the fact that many of them recover at all. How do they do that? They do it with the aid of their natural protective resources. That is the point—the point upon which the principles of this the physiologic era of surgery were developed.

The study of remote operative results is unconsciously neglected since ignorance is complete as to the anesthetic as a factor in the achievement of certain desired end-results.

A few dentists and surgeons have attained a modern mode of practice the principal thought of which is the preservation and restoration of the vital functions of the body. Operability here is considered chiefly from the standpoint of the physiologic results expected, and not from that of the mechanical ways and means of eliminating the diseased focus. In discussing treatment, the question which first calls for answer concerns what percentage of the normal functioning power of the organism as a whole will be recovered as a result of the operative procedure directed to some part of the body, so that, in applying treatment, every effort is made to protect the rest of the body from further injury while help is given to the natural forces of the organism in the defense which they have already begun, or are trying to establish against the malady. Thus, blood is transfused; digitalis is administered; insulin and other restorative and corrective medicaments are used whenever the general condition of the patient seems to be so poor as to render operative treatment extremely hazardous. And it is only when the coefficient of resistance of his vital organs has been raised to a certain level that operative procedures are attempted. But of what avail will these preoperative measures be if the dentist or surgeon does not solve at the time the problem of anesthesia? And the solution of this problem rests in the ability to choose and use, or cause to be used, the method of anesthesia which best fits the need of the patient under consideration.

The science of medicine, of which dentistry is a part, is beginning to realize that the late results can be influenced by the anesthetic service given *at* the operation.

Discussion today will be limited largely to the rôle that nitrous oxide-oxygen and procaine play in dentistry, because these are the anesthetics most commonly used or misused, as the case may be, by the dentist, and having in mind those operations most commonly done in the mouth, namely, the removal of septic teeth, alveolectomy and the removal of deeply impacted teeth, I also wish to be excused by this audience from useless discussion about the cooperation of the patient or how long I can keep them asleep.

Therefore, keeping in mind the theory

or principle of this fourth or physiologic era of surgery, let us discuss the rôle of the anesthetic. And to understand that, we must first of all know how anesthesia is brought about, or what is known as the theory of anesthesia.

The modern theory[3] holds that anesthesia is a depression of the function of nerve cells caused by curtailment in their oxygen intake. How is it that anesthetics have this power of selecting nerve cells for their action from the millions of units of which the body is composed? Taschiro has provided the answer, for he has shown that nervous tissue has a higher metabolic rate than any other, and furthermore it has been demonstrated that the more recently developed cortical cells, controlling volition and consciousness, have a greater oxygen consumption than the cells of the older and more fundamental medullary centers, which govern the vital and semi-involuntary functions of respiration and cardiovascular tone. Therefore, when there is interference with oxygen exchange, the first cells to be affected by lack of oxygen will be those that use the most. Their functions will be depressed, while other centers whose demand for oxygen is not so great will be able to carry on with unimpaired efficiency, unless the depressing action of the anesthetic is extended or prolonged to an undue degree.

The curtailment of the oxygen intake of the nerve cell may be brought about in at least three ways. The first is illustrated by the action of ether and chloroform, agents which, by their action on particular elements of these cells, so alter them that they are incapable of absorbing or using the abundance of oxygen at hand. Ether and chloroform, among other drugs, have a great affinity for cells rich in lipoids, and such cells will take up large quantities of these drugs. Following this process, the oxygen exchange between these cells and the surrounding plasma is hindered, probably by a coagulation of some of the cell proteins.

According to this latest conception,[4] anesthetic agents have been conveniently divided into two groups: direct and indirect. The former produces its action by coagulating the colloids directly and the indirect group accomplishes its action by the accumulation of waste products; which, in turn, produces coagulation. Nitrous oxide belongs to the indirect group; ether and chloroform are classed as direct agents. Many of the direct agents fall into this class because of their fat solvency capacity and are accumulated in the lipoids to act on the protein envelop.

Others, like morphine, fall into this group because of their power and ease in acting directly on some body protein and causing coagulation. Ethylene, because of its fat solvency, probably falls into the direct class. Procaine, by being thrown into direct contact with the colloids of the conduction system, is also a direct agent.

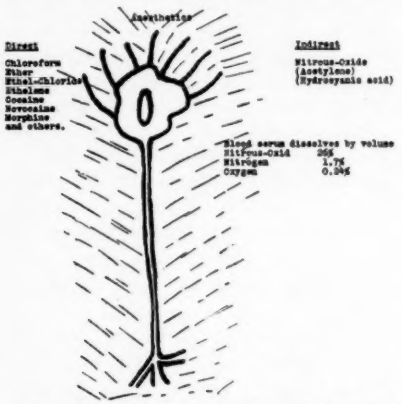
This is of greatest importance to the nerve cells, which use large amounts of oxygen. Other lipoid-rich tissue, such as the liver and other glandular organs, do not experience so much depression of function, for their metabolic rate is not so high. Thus, anesthesia is brought about by the direct or lipoid-solvent anesthetics, but it is obvious that toxic changes must be produced at least temporarily, not only in the cortical cells, but also in others rich in lipoids.

Secondly, as exemplified by nitrous oxide anesthesia, oxygen may be prevented from reaching the nerve cells by

3. McCarthy, K. C.: Gaseous Anesthetics, Toledo: Rad-Mar Press, Inc., 1933, pp. 5-8.

4. Stewart, H. B.: Physiochemists, Anesthetics and Anesthetists, Anes. & Anal., 11: 273-276 (Nov.-Dec.) 1932.

the use of agents of such great solubility in blood plasma that it becomes saturated and the free exchange of oxygen between the blood and the cell is curtailed. The amount of nitrous oxide and oxygen in the anesthetic mixture is accordingly adjusted so that enough oxygen is admitted



Graph showing division of anesthetic agents into two groups, direct and indirect. On the left are grouped the direct agents, which fall into this class because of their fat solvency capacity. On the right are grouped the indirect agents, of which nitrous-oxide is the only one acceptable for human anesthesia. It will be noted that nitrous-oxide is more than 100 times more soluble in the blood serum than is oxygen and that it is about fifteen times more soluble than nitrogen. Although the air we breathe contains about 80 per cent nitrogen and 20 per cent oxygen, the blood takes up only 1.7 per cent by volume of nitrogen, which is seven times as much as the volume of oxygen carried by the blood serum. From this 7:1 mixture in the serum, the cells have no difficulty in obtaining plenty of oxygen for normal oxidation or combustion.

to maintain the vegetative functions of the body, while sufficient anoxemia is produced by means of the oxygen-excluding properties of nitrous oxide to depress the higher functions of consciousness and volition.

It can be deducted and easily reasoned from this theory that nitrous oxide is very difficult to administer with perfection because of the necessity of waste products being formed before the narcotic action is produced and coagulation takes place. It is a simple observation that the degree of smooth anesthesia and the relaxation produced by administration of nitrous oxide is directly proportionate to the length of time that it is given. This theory also explains, to some extent, why debilitated patients who are not markedly anemic are much easier to anesthetize quickly with nitrous oxide than are healthy persons whose waste products in the plasma and blood cells are at a minimum. The waste products produced by nitrous oxide are undoubtedly natural waste products, much the same as those produced by the body when we become sleepy each night, and hence are easily thrown off as consciousness reappears.

Thirdly, internal respiration may be hindered by the accumulation of carbon dioxide and other end-products of tissue metabolism and parenchymatous degeneration. The coma characteristic of acidosis and marked toxemia is in many respects analogous to anesthesia.

Anesthetics do not merely inhibit the action of the nervous system,[5] but they alter to a greater or less degree the function and metabolism of every cell in the body. If the patient's system is in proper condition to counteract these changes and to restore normal metabolism when the anesthetic leaves the body, no harm will be done. If the system is not in condition to be restored to normal, serious results will be encountered.

In discussing the effects of anesthetics on the system, it is well to divide them into two classes: primary effect and secondary effect. The primary effects are the changes produced by the anesthetics

5. Hughes, J. S.: Anesthesia and Metabolism, Anes. & Anal., 4:3 (Feb.) 1925.

themselves on the cells of the body. The secondary effects are the changes in the body arising from the derangement of normal metabolism. Thus, we could classify the effect of the anesthetic in inhibiting oxidation as a primary effect; while the harmful effect of the acids produced by this lowered oxidation would be classified as a secondary effect.

Referring again to the principle of this, the fourth or physiologic era of surgery, we find that there is only one anesthetic for practical use in our whole armamentarium that produces anesthesia by purely physical means, namely nitrous oxide-oxygen. We have to consider the secondary effect of this anesthetic before we can justify its use on these grounds, and since we know that its anesthetic properties lie in its ability to depress the higher functions of consciousness and volition by its anoxemic action, it will be necessary now to discuss the phenomena of anoxemia, asphyxia and cyanosis as they are related to nitrous oxide-oxygen anesthesia.

I cannot do better than to quote from a paper by de Caux showing the meaning of these terms:

Anoxemia, cyanosis and asphyxia are not synonymous terms. Anoxemia, for example, is not the modern word for asphyxia, as one writer naively defines it; it merely means the absence of oxygen from the blood. As asphyxia cannot suddenly be produced, there will be various stages between normally oxygenated blood and asphyxia, so we speak loosely of various degrees of anoxemia. The name given to the train of signs caused by depriving the patient of oxygen is asphyxia.

With regard to cyanosis or "blueness," it is possible to have a cyanosed patient who is not being asphyxiated and vice versa. Cyanosis is merely due to there being more hemoglobin than oxyhemoglobin in the capillary circulation of the skin. Now, in the plethoric patient, there is more hemoglobin than is necessary. In other words, a small percentage of it can carry all the oxygen required for his physiologic needs. This being so, the patient can easily be cyanosed without being asphyxiated. In an anemic patient, on the other hand, there is so little hemoglobin that all of it is required to carry oxygen in the form of oxyhemoglobin, and the smallest diminution of oxyhemoglobin will produce asphyxia, but not cyanosis.

The phenomenon may be compared to a river full of cakes of ice floating down stream and covered with snow. Cakes of ice thick in the river and covered with 1 inch of snow will look different from cakes of ice that are few and far between and carrying 1 foot of snow, but more snow may be coming down on the ice that has the fewer cakes.

This phenomenon is so little understood by both the dental and medical professions that, because of it, the anesthetic, nitrous oxide-oxygen, is more often cursed than blessed, when the reverse should be the case. Nitrous oxide-oxygen cyanosis without symptoms of asphyxia has never been shown to have any harmful effect. It has, on the other hand, saved more lives than all other signs of anesthetic overdose that can be mentioned. It is the one outstanding phenomenon that even the most ignorant and careless operator could see, though he never knew an eye sign, muscle sign or respiratory sign of anesthesia; and he usually did something about it, i. e., removed the mask, and nature did the rest. In this way, more lives have been saved by cyanosis than by all the red lights in front of all the crossings of all the railroads in the world and all the four wheel brakes on all the automobiles. I cannot fathom the frame of mind of the physician who will, because of a mild symptomless cyanosis of nitrous oxide-oxygen anesthesia, with good respiration, a proper pulse and blood pressure and correct eye-signs of anesthesia, condemn this anesthetic and

praise a spinal anesthesia with a pulseless patient, the blood pressure being so low that epinephrine and carbon dioxide-oxygen must be used to resuscitate the patient.

I was much impressed a short time ago by the returns from a questionnaire that was sent out to most of the dental colleges in this country, asking for a list of five of the questions most frequently asked by the student in regard to nitrous oxide-oxygen. In every one of these returns, the outstanding question was: What physical examination do you make before using nitrous oxide-oxygen? It seems to me that there is something wrong with the education of these dental students as well as medical students, reflected later in the attitude of their patients at large, if they believe that when gas-oxygen is used, a physical examination is necessary, with particular reference to the heart, and that such examinations can be dispensed with when a local anesthetic, i. e., procaine, is used. It is inferred that nitrous oxide-oxygen, being a general anesthetic, causes a strain on the heart, when the fact of the matter is that both the nitrous oxide and the oxygen are mild cardiac stimulants. Any textbook on pharmacology will tell you that, and if you have ever taken blood pressures during anesthesia or do any laboratory work on animals, you will have found it out.

My answer to such a question would be that there is nothing to prevent us from knowing our anesthetic and then treating every patient as though he were the worst possible risk, leaving nothing to chance, not even the word of the physician who says that the heart may be all right. Even he may be wrong; and, in any event, the deaths from the anesthetic are far from being all heart cases.

As an example of heart affections and gas-oxygen anesthesia: Angina pectoris is a very serious affection of the heart, and still we have expert medical anesthetists[6] (physicians or dentists who make a specialty of anesthesia) that can and do use gas-oxygen in full anesthesia as a therapeutic measure to tide patients over an attack. These cases[7] fare badly under local or regional anesthesia, more particularly when epinephrine is used in conjunction with the drug employed. In fact, epinephrine has recently been employed in a provocative test in doubtful cases of angina pectoris, and persons prone to this disease have exhibited serious reactions.

The explanation for all this lies in the fact that the medically trained anesthetist knows that angina pectoris[8] is a syndrome caused by anoxemia of the myocardium, whether the pathologic condition associated therewith be (1) coronary disease, (2) aortic insufficiency or (3) a miscellaneous condition, and that, by the proper use of oxygen in the mixture, the oxygen required by the myocardium can be supplied.

The local anesthetic solution[9] used in such a case should not contain any epinephrine for two reasons: (1) that sympathetic stimulation is induced, which results in tachycardia, and (2) vasoconstriction occurs with a resulting elevation of blood pressure, which might induce a coronary thrombosis.

The substitution of epinephrine has yet to show that it does not cause sympathetic stimulation and elevation of blood pressure on the one hand, nor permit the ab-

6. Gwathmey, J. T., disc. of Parsonnet, A. E., and Hyman, A. S.: Heart in Dental Surgery with Special Reference to Anesthesia, D. Digest, 37:293 (May) 1931.

7. Cottrell, J. E., and Wood, F. C.: Effect of Epinephrin in Angina Pectoris, Am. J. M. Sc., 181:36-39 (Jan.) 1931.

8. Keefer, C. S., and Resink, W. H.: Angina Pectoris, Syndrome Caused by Anoxemia of Myocardium, Arch. Int. Med., 41:769-807 (June) 1928.

9. Horine, E. F.: Anesthesia in Heart Disease, Anes. & Anal., 13:129 (May-June) 1934.

sorption of the anesthetic into the circulation too rapidly on the other, thereby increasing its toxicity.

Since dentists and physicians routinely use epinephrine in their local anesthetic solutions, and since they do not routinely examine their patients for arteriosclerotic heart disease when using this drug, I repeat that there is something wrong with their education when they feel that a physical examination is necessary when nitrous oxide-oxygen is used with particular reference to heart disease, and that all such examinations can be dispensed with when a local anesthetic is used. Ignorance on this point probably accounts for that age old alibi: "The patient died of heart trouble, *only* a local anesthetic being used."

Nitrous oxide's lack of toxicity is due to the fact that it is an inert gas which produces anesthesia by purely physical means. This makes it the anesthetic of choice in all toxic and infectious diseases, when the body has all the toxins and more than it can handle. As Crile puts it:

> Ether anesthetizes the phagocytes as well as the man, and so places the patient in the position of a citadel when, at the hour of assault by the enemy, the defenders are asleep in the trenches. If nitrous oxide-oxygen be used, however, the phagocytes remain ready for action and the danger of infection is, therefore, lessened.

It is of interest[10] to note that, at the recent meeting of the American Medical Association, one of the most interesting lectures concerned a new disease, now called granulopenia, which is caused by administration of some of the newer pain-killer drugs which inhibit the production of the germ-killing white blood cells in the marrow. In the United States, 1,300 deaths have been reported in three years. Surely it should be of equal interest to dentists, physicians and surgeons to know what effect anesthetics have on the blood cells and other tissues of the body.

The secondary effect of nitrous oxide-oxygen is also physiologic.

Several very basic considerations are involved in the difference between nitrous oxide-oxygen and procaine anesthesia. To begin with, nitrous oxide is a gas that goes into and leaves the system with the rapidity of oxygen, and as yet no one has been able to discover that nitrous oxide forms any combination with any of the fluids or tissues of the body or that it affects any of its organic functions. The worst that can be said about it is that when it is not properly given nor with sufficient oxygen, it may cause anoxemia, cyanosis and even asphyxia, if allowed to go that far. None of these effects are inherent in the gas or the method of anesthesia, and, as a rule, they can be entirely avoided. What is more important is the fact that nitrous oxide must be given with an amount of oxygen which, to all practical purposes, neutralizes any untoward effects that the nitrous oxide might have. Many who are ill-qualified to use this anesthetic assume responsibilities for which they are in no way prepared by judgment, experience or learning. This is one of the vices of this era of surgery that accompany its virtues. It is a wonder that so many patients live after anesthesia by persons who are incompetent as real anesthetists.

The anesthetic service in your hospital with nitrous oxide-oxygen in the hands of nurse anesthetists has been a complete breakdown. The usual result is that the gas is used merely as a vehicle to bring the ether to the inhaler, a supercharge to the patient and a counterfeit anesthetic resulting. No general surgeon is so quick on the trigger that he can supervise a gas-oxygen anesthesia from his field in the abdomen in the sense that he can supervise an ether anesthesia, and a den-

10. Time, June 25, 1934.

tist who, by the very nature of his work, can observe all the signs of anesthesia must have years of experience and be one of a competent surgical team.

On the other hand, procaine is injected into the tissues, on which it has the effect of producing edema and localized acidosis. If injected in sufficient amounts, it may pervade the entire system. It is broken up in the liver and partly excreted by the kidneys. Its effects on the liver were observed years ago by a British surgeon, who noticed that practically all of his patients who had been operated on under procaine showed jaundice of the eyeballs after operation. Several other observers have noted considerable albuminuria following the use of procaine. More recently, studies have shown that undesirable procaine reactions and complications usually appear in these cases in which procaine appears in the urine. This is especially true in relation to spinal anesthesia.

In view of these effects on the liver and kidneys, it would appear that procaine anesthesia is not without its degree of danger when used in a patient with liver and kidney diseases.

Procaine[11] affects the bundle of His (of the heart), and this affect accounts for the peculiar type of convulsive asphyxia which is found in certain deaths from procaine. Taschiro found that local anesthetics had the same effects on deoxygenation and delimitation of carbondioxide as had general anesthetics. Procaine seems to interfere with the oxidation process of the red cells and blood plasma; which brings on these asphyxial convulsions.

It has been my experience that the dentist or surgeon discounts psychic and secondary shock after local anesthesia, and if you want the true story, you have to get it from the nurses or the patient.

The only way to relieve depression and shock is by the use of pituitrin instead of epinephrine, with the local anesthetic. This endocrine extract is effective in this condition because it is the mordant which enables the red cells and the blood plasma to resume the process of oxidation interfered with by the procaine.

From these results, it seems that the procaine effect is a direct one rather than a psychic effect. In certain types of patients, the psychic effect can also be very pronounced of itself.

The most pronounced effect of procaine in dentistry is the reactions which occur after the use of procaine for the extraction of septic teeth. Here, the advisability of extracting only one tooth at a time under procaine must be stressed, as well as the importance of waiting from twenty-four to forty-eight hours to note the reaction. If there is little rise in pulse rate and temperature, very little fall in blood pressure and only slight malaise, procaine anesthesia can be repeated after a short interval, but when there is a decided rise in pulse rate and temperature, a pronounced fall in pulse pressure and a severe reaction with chill and malaise, it is very dangerous to repeat the procaine injection until some time after the reaction has subsided. Under no circumstances is it advisable to extract a large number of septic teeth at one time under procaine, on account of the danger of the reaction. I know from years of experience that nitrous oxide-oxygen is entirely free from this sort of thing.

By the same token, I am not particularly impressed by those accounts in the literature which speak of the tragedies that follow the removal of teeth where swellings exist and do not mention the anesthetic used. Either they do not mention any anesthetic at all or, very rarely, mention ether. Such case histories are both

11. McMechan, F. H.: Personal communication to the author.

unscientific and incomplete and show a tendency to evade the facts. To use either a local anesthetic or ether in these cases is to break down the very body defenses against invading micro-organisms that we are so anxious, in this phsyiologic era of surgery, to maintain. So let me call attention at this time to the fact that even in blood diseases, nitrous oxide-oxygen anesthesia does not cause blood dyscrasia. In my thirty years in dentistry, eighteen of which have been limited to exodontia, I have never regretted removing a tooth in the presence of a swelling, ruling out only swelling from an acute Vincent's infection; but I have regretted when, for one reason or another, I have compromised in these cases. But, in all these cases, there was no local anesthetic or ether used. In all of my cases of osteomyelitis and Ludwig's angina originating from teeth, there has always been a history of local anesthesia. I do not wish to be misunderstood on this point: All cases of osteomyelitis or Ludwig's angina are not caused by local anesthesia, but the use or misuse of the anesthetic is an important factor in the outcome of the case.

In previous articles,[12] I have pointed out the prophylactic value of using nitrous oxide-oxygen in the removal of diseased teeth to avoid systemic reactions, and have called attention to the fact that the resistance of the tissues themselves to the invading bacteria will be a factor in determining whether the bacteria are killed quickly or begin to grow. Thus, tissue in which local anesthetics produce edema, and therefore interfere with the blood supply and oxygen tension, becomes a favorable culture medium; for, in mouth operations, we are dealing largely with the facultative anerobic type of bacteria. The surgeon[13] of today knows that the key to defense against infection possessed by any part of the organism is its blood supply, and that an abundant, normal blood supply augmented by physiologic rest supplies the natural "asepsis."

Blood[14] develops bactericidal properties during the preliminary stages of clotting, which brings about the formation of thrombin. The delayed clotting of blood, as seen in the mouth operated on under local anesthetics, is but one of the bad features of this type of anesthesia.

An important problem of anesthesia in the mouth by use of the needle is trauma, both from the needle and from the solution injected. Bassler[15] mentions that this traumatization of tissue is of no small moment and mentions such end-results as infection and severe injury to important and fair-sized nerve trunks; the "knocked out" feeling lasting for days and sometimes weeks after; listlessness, anorexia, pallor and melancholic conditions; intense pain in the face, jaw and mouth, with a burning sensation in the tongue; anesthesia of the tongue and lips lasting for a long period of time; paralysis of the legs and other parts of the body following lesions of the central nervous system; brain abscess, meningitis, cortical abscess of the kidneys, lung abscess, septicemia, ulcerative endocarditis and phlebitis; many of the conditions resulting in death. There is no sizable area of the mouth that can escape this trauma

12. Harms, B. H.: Prophylactic Value of Using Nitrous Oxid-Oxygen in Removal of Diseased Teeth to Avoid Systemic Reactions, Anes. & Anal., November, 1921.

13. Crile, G. W.: Value of Drugs in Surgery, Anes. & Anal., November, 1921.

14. Walsh, V. G., and Harmsworth, Daphne: Influence of Coagulation on Bactericidal Power of Blood, Brit. J. Exper. Path., 8:135-138 (April) 1927.

15. Bassler, Anthony: Physician's Attitude Toward Some Results from Use of Local Anesthesia in Dentistry, M. J. & Rec., 133:424-425 (May) 1931.

whether the injections are made for infiltration anesthesia or block anesthesia; which brings us to the point of how to meet the problem of anesthesia in the mouth.

As has been shown, nitrous oxide-oxygen would be the anesthesia of choice if it did not require so much in the way of special apparatus, gas always on hand and an attendant in the office; also the need of more training of the dentist for the type of operations now demanded over that of a decade ago.

With procaine anesthesia, there is no further advance to be made even though the procaine be rendered absolutely nontoxic. We must get away from the method of anesthesia which brings about trauma and edema of the tissues. More toxic agents are repeatedly coming to us from the chemists, and these are undesirable because of the production of waste products of which our vascular systems cannot rid themselves. Future anesthetics will be scrutinized severely from these angles in the light of our newer conceptions of their mechanism, and it is possible that unless we are familiar with and trained to understand their merits, the manufacturers may be handicapped in presenting them. Perhaps some inhalating anesthetic will be found that will not have the drawbacks of nitrous oxide-oxygen and will make a better start than did ethylene; perhaps some nontoxic drug that can be given by mouth as barbital is or by vein as sodium amytol is given, but more readily controlled, and in which the lethal and the anesthetic doses have a wider margin. In any event, any method of anesthesia which requires any particular effort on the part of the dentist is not going to be very popular.

SUMMARY

1. The anesthetic plays a very important rôle in this, the physiologic era of surgery. By the use of an ill-chosen anesthetic, a seemingly simple operation may end in a tragedy.

2. Nitrous oxide-oxygen, in properly trained hands, is the criterion of all present-day anesthetics for operations in the mouth, the only anesthetic that produces anesthesia by purely physiologic means and does not interfere with the conservation of the natural resistance of the patient (phagocytes and antibodies). Recovery from the anesthetic is prompt.

3. Procaine, first by the very nature of its chemical action and secondly by its method of application in mouth operations, interferes with the conservation of the natural resistance of the patient, the phagocytes and antibodies, and prolongs recovery.

SUBGINGIVAL TREATMENT IN ORAL SURGERY*

By AMOS BEEBER VASTINE, D.D.S., Bloomsburg, Pa.

THIS paper amplifies the premises set forth in a paper read before the Section on Research in 1930.[1] That paper, with its predecessors, grew out of a careful clinical correlation of such laboratory data as have been available for my study during the past twenty or more years.

The intimate interrelation of the nasopharyngeal boundary and the alveolar trench, which I have emphasized, becomes more and more apparent with the lapse of time. The intricacy of this problem, as well as the artificial, not to say arbitrary, academic boundaries which have been established, makes this important phase of subgingival treatment difficult to expound.

The negative factors in subgingival disease are fairly well presented and accepted, especially that part which relates to avitaminosis. There is yet much need to educate the clinician as to the place for each of the vitamin agents according to the signs and symptoms indicating their respective uses.

The subgingival method, which depends on a technic that I have developed, takes advantage of negative pressure and the sealing of the medicament against dilution. There is absolutely no connection between this technic and massage, which has no place whatever in the system. "The system of subgingival treatment," to quote a previous paper, "rests on the use of a specific or near specific introduced at the point of incubation for the causative organism." There is no appreciable dilution of the medicament. The medicine is carried by a suitable rubber cup attached to a contra-angle porte polisher or a hemostat. The cup is filled with the agent, contact is established with the tooth, and the edge of the rubber is introduced under the free margin of the gum by a pumping motion. Adhesion results, which enables the applicator to be carried into the deepest pocket and the drug to be expelled. This method may be used for obtaining smears and cultures, as well as enabling the operator to convey the specific or near-specific under the gingiva, to the point where actual destruction of the osseous or other structure is going on, or where a focus of infection is being established in the form of a vulnerable resistance mechanism.

"Subgingival treatment . . . is distinctly valuable as the most effective method we have yet found for preoperative preparation."[1]

The term "subgingival therapy" is used to emphasize this broader concept of the interrelation of the whole body mechanism with subgingival disease.

The major consideration presented by the local oral condition is whether it be cause, effect or incident in disease and what bearing this morbidity has on the hazard of the proposed operation. If this

*Read before the Section on Periodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

1. Vastine, A. B.: Research in Subgingival Therapy, J.A.D.A., 17:507-511 (March) 1930.

risk has been properly evaluated, subgingival treatment will be found to profoundly modify the postoperative problem in 100 per cent of the cases handled. The protection offered those operators in clinics where a physical survey has been more thoroughly made than is possible for the average practitioner makes statistical comparison of far less value than data taken from the practice of oral surgery at large.

The scope of this paper does not permit an analysis of the material that a practice of thirty years has afforded. Only some outstanding gleanings are here presented.

Under personally supervised subgingival treatment and a physical survey, not a death nor a grave postoperative complication occurred when a dentectomy was included in the operation. The exceptions have existed when the removal of teeth was not involved in the operation. In no instance has stage operation been practiced, except for prosthetic convenience. Rarely have complications resulted from complete clearance. Only two cases admitted to my service for postoperative complications proved fatal when all the teeth in one jaw had been removed at one operation. In both instances, the operators did not know their patients had a high blood sugar content. Preoperative subgingival treatment had been given one and not the other. I have had many patients on my service for serious complications following the removal of just one tooth, death occurring in some instances. In one case that proved fatal, I had warned the patient not to have the tooth removed unless subgingival treatment was first instituted.

These data are presented to make clearer the principle involved in preoperative subgingival treatment.

The local field presents several well-defined avenues to the control of postoperative reaction: In the subgingival avenue, the reaction may be acute, subacute, chronic, superficial and deep. The pertinent bacteria are mostly Vincent's spirilla, streptococci and staphylococci. The local syphilitic as well as some other manifestations may be relieved by the preoperative treatment; which tends toward a misleading diagnosis. In the periapical avenue, the reaction may be acute, subacute or chronic. The pertinent bacteria are streptococci. In the cystic avenue, the reaction is subacute or chronic, of traumatic, subgingival, developmental or periodontal origin. The type of cyst may be: The exfoliating, as in the follicular cyst exposed to the surface infection by way of the exfoliating and erupting tooth, or the deciduous periapical. The superficial cyst, being radicular, follicular or traumatic, through rarefying the surrounding osseous structure, becomes exposed to surface contact. The organism found in these cysts depends on the stage as well as the degree of surface exposure.

The submerged cysts present a first, middle or end stage. The exposed cyst does not pass into the end stage. The fistulous or interstitial tract may connect the source of invasion with the nasal or antral floor, the peritonsillar structure or retromolar area or the salivary glands.

There are other direct avenues of invasion, such as the submaxillary lymph channels, or a cellulitis or a gross abscess may develop. These manifestations may require auxiliary preparations other than the subgingival preoperative. Chief of these is the wet dressing of 1 ounce of 25 per cent glucose to a pint of normal physiologic sodium chloride solution. This form of wet dressing I suggested some years ago. Its effectiveness surpasses, in my use, anything so far recommended.

"Subgingival treatment is a most effective method for treating acute and chronic gingivitis."[1]

Acute gingivitis is so seldom present as a distinct oral entity that it would be more accurately spoken of as an oral nasopharyngeal infection with acute reaction in certain areas, such as the maxillary and mandibular trench, the nasal wall, the tonsils, the pharynx or the retromolar areas. This interrelation often requires microscopic examination to demonstrate the connection.

The proneness to confine the treatment to a limited area and a lack of full appreciation of the necessity for care of the negative factors, such as avitaminosis, dehydration and gastro-intestinal toxemia, account for the lack of prompt response to treatment where efficient specific medication is used with a proper technic. Alertness in detecting blood dyscrasias is very vital in this field.

In the chronic form of subgingival infection or gingivitis, the same principle applies as in the acute form. The clinical picture is one of degree rather than any essential difference as to the diagnosis and treatment. The focal infection factor, taking the place of the direct metastatic factor, results in the medullary infection playing a greater part than it does in the acute form. Time does not permit treatment of this phase of the subject so extensively as its importance warrants.

"Subgingival treatment is most effective for infections around erupting teeth and the retromolar area."[1]

It is difficult to determine just which one of the uses for subgingival treatment is the most valuable. For the particular purpose of relieving the acute and chronic infections associated with erupting teeth, I have found no substitute for subgingival therapy.

There is a disposition to regard the very young child as being free from subgingival or follicular infection. Vincent's and mycelia infections may be encountered before the teeth are erupted. It is not unusual to find evidence of true subgingival involvement around erupting mandibular incisors at 4 months of age. It is quite frequently seen at from 14 to 18 months when the follicles show infection of the subgingival origin around the adjacent erupted teeth. I have under my care a child, 11 years of age, who had suffered from a severe chorea minor, which was perfectly controlled by subgingival treatment for Vincent's organism and streptococci in the follicles under the bicuspids. The infected and expanded follicles caused a reflex disturbance. Chorea might have resulted from an impaction, a cyst or inhibited dentition. The retromolar complications attending third molar eruption are readily controlled by efficient subgingival treatment. These reactions are usually activated by Vincent's organisms with the streptococci. Sometimes, the staphylococci and, very exceptionally, *Amoeba gingivalis* are partly responsible.

"Subgingival therapy is most effective for controlling certain cases of osteomyelitis."[1]

Nonspecific osteomyelitis usually has its origin in either a subgingival or a periapical infection grafted on a suitable resistance background, especially deficiency diseases such as avitaminosis (A and D). This being true, it is logical that prevention and control of osteomyelitis of the mandible and maxilla, particularly in children, center around subgingival treatment. I have been able to prevent the loss of the tooth buds and forming teeth by the use of specific medication around the teeth involved, directed by means of smear and culture identification of the organisms. In some cases, none of the permanent teeth was lost. In other

instances, the loss was reduced to one or two teeth. The same principle holds true in the adult, but, here, the field is not complicated by the dental follicles and the unusual metabolic demand associated with dentition. The staphylococcus has been more difficult to wrestle with than the streptococcus. Vincent's organism is usually an introductory or a complicating factor in osteomyelitis. Preventing osteomyelitis by appropriate subgingival treatment has tremendous value. With one exception, the four osteomyelitic cases that I now have under my care could have been avoided if subgingival treatment had been instituted before the removal of the teeth. I am not absolutely certain that this is not true of the other case also.

"Subgingival therapy is effective for relieving acute periapical infection."[1]

This is one of the most spectacular and most difficult aspects of subgingival treatment to teach because of the popular idea that massage and contact of the medicament is the therapeutic basis of this system. The subgingival control of acute and subacute periapical infection constitutes a fine distinction which is seldom recognized. The foundation fact is that the periodontal circulation is directed toward the apex of the tooth root. I know of no authenticated demonstration of any but a streptococcus activating a periapical infection; which rules out all but a streptococcicide, which may be carried by the blood stream and not by mere contact, osmosis or capillarity. In these conditions, there is always some exaggeration of the subgingival trench where the lip of the applicator may be introduced and the seal made perfect for negative pressure, which permits absorption of such a drug as may lend itself to carrying by the blood supply to the cyst wall. The incipient cyst is always a prerequisite for an acute periapical infection. The prompt effect on the organisms relieves the inflammation at its source, causing, in most instances, an arrest of the pain within a few minutes. Repeated treatment may or may not be required. Recently, I have advocated in some severe cases that the cup, after being filled with the drug, be placed with the hemostat and allowed to remain until pain is relieved without the support of the handle. Counterirritation or drainage is seldom or never a factor in relief. If the periapical infection has gone into the cellulitis or abscess stage, spectacular results will not be obtained, but subgingival treatment has value in some cases even in this stage. It is in this application of subgingival treatment that the difference between superficial and deep organisms may be demonstrated, as well as the stage in cyst formation, both gross and bacteriologic. The spectacular results obtained in the treatment of the acute and subacute stages of periapical reactions are not gained in treating the end stage or focal infection type associated with the pulpless tooth. In these conditions, if a proper technic is used, growing cultures may be obtained in spite of subgingival treatment. This rules out subgingival treatment as a means of protecting pulpless teeth against becoming a factor in the focal syndrome.

"Subgingival therapy is effective for treating in children or in adults glandular involvements having their origin in gingival or follicular infections."[1]

The subgingival technic not only has value in treating the adenitis secondary to the subgingival infection, especially of streptococcic origin, but also it permits, in many cases, the making of an accurate differential diagnosis, usually between adenitis of tonsillar origin and follicular, subacute periapical or subgingival origin. There has been a recognition of the subgingival, tonsillar pathway as a portal for adenopathy of tuberculous origin.

These pathways for the nonspecific infection have not been given the consideration their importance warrants. There is a tendency to overstress the rôle of this acid-fast organism in cervical and submaxillary glandular involvement.

The response to subgingival treatment, especially for the streptococci, in the periapical, subgingival or tonsillar fields, will make the etiology obvious in many of these cases of adenopathy.

"Preparation for operating in a maxillary sinusitis of dental origin whether having a periapical, follicular or gingival source."

The close relation of the alveolar trench to the antral floor, as well as a certainty that a large proportion of cases of sinusitis (of all the paranasal sinuses) have their origin either in, or are complicated by, certain conditions around the alveolar trench, makes the subgingival pathway of great importance in this field. The foregoing statement will be deemed radical by many, but the more thoroughly I go into the problem of sinusitis, the more deeply convinced do I become of its accuracy. My experience is based upon the personal handling of all forms of sinusitis including those cases complicated by frontal lobe abscess.

The approach of choice, in either simple or radical antral or anterior ethmoidal operation, is by way of reflection of the alveolar mucosa at the cervical margin. If the teeth are absent, a line about 2 mm. above the crest of the alveolar process is used.

When the condition is of dental origin, subgingival preoperative preparation is of even more importance than if a dentectomy alone were to be performed.

The most convincing data one can offer as to the value of preoperative preparation for sinus operation are the number of cases of acute maxillary sinusitis that may be relieved, when not in the operable stage, by efficient subgingival treatment with a streptococcicide followed by a spirocheticide. I have seen many instances wherein morphine failed to relieve the pain and two or more subgingival treatments gave complete relief. This permitted the performance of a radical operation when simple irrigation for clearance was not effective. This operation may be safely performed, where necessary, in from twenty-four to forty-eight hours after the relief of acute symptoms.

"Subgingival therapy is effective for eliminating certain forms of facial dermatitis."

The term facial dermatitis, as here applied, denotes those skin reactions secondary to infections about the alveolar trench and may be manifested in any form from erythema or acne to a fatal cellulitis of the nose or lip. One of the most spectacular of all results that may be obtained from subgingival treatment is the relief of a severe, sometimes grave, cellulitis of the nose having a periapical source. The most frequent offender is a bicuspid, maxillary or mandibular. Next in frequency are the maxillary incisors or cuspids. The tonsils are occasionally responsible. A furuncle of the ear may be secondary to retromolar or tonsillar infection. Subgingival therapy here again lends itself as a means for both treatment and differential diagnosis.

"Subgingival therapy is effective for reducing some larger intra-oral cysts before operation."[1]

It is possible to reduce the dimensions of the maxillary or mandibular cyst when it is present in its first or second stage, but not when it is in the end stage. The amelioration is genuine if, in the radicular cyst, the causative factor is accessible in the form of a pulpless tooth, or, in the follicular cyst, in the form of an adjacent tooth.

A specific streptococcicide or staphylococcicide introduced into the cyst cavity, after aspiration of its contents and recognition of the organism, is the most effective means of reducing the dimensions of these cysts. This fact makes the subgingival approach of primary value when there is an acute reaction present.

The length of period of incubation of the subgingival organisms has a practical value as well as an academic one. The determination of this cycle must be arrived at individually. It is usually done empirically by noting the subjective symptoms as expressed by the patient. Clinically, it is determined by noting the degree of inflammation, necrosis or resorption as checked by smear findings. The results are checked scientifically by a negative smear obtained for the first time as a result of effective treatment. Daily checking by smear for recurrence of the organism is then done. At the same time, it is important to register the alkalinity or acidity of the subgingival field, of the mucoid secretion and of the saliva. It will be found that there will be definite recurrent cycles of incubation. This is especially true of the spirilla of Vincent. With these organisms, the subgingival reaction varies toward the acid side before the active cycle of incubation occurs.

In some instances, the relation between the alkalinity of the saliva or mucous secretions and the subgingival secretions will register some form of general lowering of resistance independent of the subgingival reaction. The difference between an acid reaction, produced as a result of the activity of the subgingival organisms (especially Vincent's), and that which results from some alteration in metabolism, is one of the many intangibles to be reckoned with in this field. Some cases will register a monthly cycle of incubation; some, a weekly; and certain severe cases, a diurnal.

It is for this reason that follow-up treatment is strictly an individual equation and must be worked out for each patient separately. As I have stated above, this is ordinarily done empirically.

Under the head of treatment, I have added little since presenting the last paper. The most potent spirocheticide by far is arsenobenzol, or arsphenamine, and not the later modification of this arsenical. Five per cent arsphenamine in glycerine is good for home use by the patient who has been taught the use of the subgingival applicator. The streptococcicide of 5 per cent mercurochrome (aqueous preparation) is still the best agent that I have found for the control of acute periapical infections. It is carried under negative pressure, by the periapically directed circulation, to the forming cyst wall. I have found nothing to take the place of acriviolet in 1 per cent aqueous dilution for the superficial staphylococcus infection. For the deep infections, as represented by staphylococcic cellulitis, the wet dressing of saline solution and glucose supported by contact staphylococcicide after surgical exposure or drainage seems to constitute the best treatment. Gentian violet is very effective for some yeast or mycotic organisms.

The incorporation of arsphenamine in emulsified oil or hydrocarbon makes by far the most valuable spirocheticide that we have for Vincent's organism or for primary syphilitic lesions about the oral, nasopharyngeal or other mucosal tracts. This mechanical mixing of arsphenamine in a hydrocarbon or emulsified mineral oil free from all adulterants (with the possible exception of phenolphthalein or phenol and glycerine) has been my greatest step forward in the handling of Vincent's infection as well as other of the superficial organisms. It permits of as much as a 50 per cent, by volume, preparation. The arsphenamine slowly dis-

solves in the oral or other secretions, which prolongs its effectiveness for hours. It is important that this treatment be given with a freshly prepared arsphenamine oil mixture. When the local subgingival, tonsillar or other fields have had their alkalinity lowered, the resultant acidity tends to coagulate the preparation, making it more slowly soluble. As the organisms are destroyed, alkalinity increases and the preparation becomes more rapidly effective. The use of a deep streptococcicide before using this preparation is important because healing may become so rapid that an acute form of subgingival reaction may be walled in, a secondary metastatic reaction such as a cellulitis of the nose resulting. The value of this preparation for the local elimination of the amebae is so effective that it is seldom necessary to consider any other form of amebacide.

The mouth wash formula that I have found of the greatest value for routine use is as follows: sodium chloride, 1 dram; sodium bicarbonate, 1 dram; tincture of iodine U.S.P., 0.5 dram; distilled water, 1 pint. This is allowed to stand in a cool place until the solution is colorless. When the preparation is held in the mouth for five minutes, the heat of the mouth at first liberates a small quantity of free oxygen. Later, the reducing effect of the iodine becomes effective with saline dissolving the mucoid débris. The sodium bicarbonate tends to saponify the fat débris and increase the subgingival alkalinity. The low cost of the preparation, as well as its pleasant effectiveness, makes this simple prescription of value in postoperative care. A mouth wash should not be used until twenty-four hours after operation or in the treatment of the severer forms of Vincent's disease, as it tends to dilute the blood clot or the adherent medicament.

The value of the subgingival technic in getting smears and cultures is great. The smear, as obtained from about the teeth from contact with the deepest pockets, is so thorough and the possibility of covering every point in the mouth is so easy of achievement that a complete cross-section of all the subgingival flora may be readily obtained. The technic consists in having available a half-dozen or more sterile cups, together with a flamed hemostat with which to pick up the cups from the sterile container. The subgingival débris is washed off into three or more drops of saline which have been put on a glass slide. A cover slip is placed and the specimen studied without staining under the high dry power microscope.

The scope of subgingival treatment is of such magnitude that only the most superficial allusions have been made to its possibilities. The great difficulty lies in so presenting it that its possibilities may be taken advantage of by those who come in contact with the diseases for which it is useful.

SUMMARY

I shall merely reiterate the conclusion that I set forth five years ago, stressing also the use of emulsified mineral oil, unadulterated, as a vehicle for carrying the arsphenamine powder in mechanical suspension. This is an important new addition to the treatment.

"Subgingival treatment has a wide range of use, but it is distinctly valuable as the most effective method that we have yet found for preoperative preparation. It is a most effective method for the treating of retromolar areas; for controlling certain cases of otseomyelitis; for relieving acute periapical infection; for treating, in children or in adults, glandular involvements which have their origin in gingival or follicular infections; for the treatment of, or preparation for operation in, maxillary sinusitis of dental origin (periapical, follicular or gingival

source); for reducing some larger intraoral cysts before operating (thus simplifying operative technic), and for eliminating certain forms of facial dermatitis. Thus, it is seen that, through the realm of oral disease and its manifestations, we have a direct or an indirect use for subgingival therapy."

It is a matter of regret that the outstanding value of subgingival treatment as a health service has not received the wider recognition that its scope and effectiveness justifies, but, to paraphrase an old adage, little drops of observation, little facts assembled, make a mighty contribution and a fine profession.

THE ROENTGENOGRAM, A GUIDE IN CHILDREN'S DENTISTRY*

By L. R. MAIN, D.D.S., St. Louis, Mo.

IT makes little difference whether the dentist is engaged in general practice or in one of the well-known specialties of dentistry when we come to consider the advantages of the roentgen rays. We have long since passed the experimental stages in the use of this valuable adjunct as a necessity of every phase of practice, but now the need for constant effort at refining our technic and improving our ability to interpretate roentgenographic shadows must be emphasized, as much of our work in radiodontia is of too low standard to be depended on in every detail.

Experience plays an important part in radiodontia provided it carries with it a reasonable effort by the operator to understand and appreciate the dental point of view. The roentgen rays have demonstrated, to the profession at least, many of our shortcomings. They reveal, to a remarkable degree of accuracy, our failures in canal filling, in restorations and in exodontia, and their chief uses by the average practitioner are in these channels. I would not in any sense minimize the importance of the rays here, but there is another use which is as far reaching in its beneficence and which is too frequently overlooked: I refer to the use of the roentgen rays as a guide in children's dentistry.

Their use in pedodontia is of course very similar to their uses in adult dentistry, but there is one marked advantage gained by early use, and that is in the information obtained during the process of dentition. Their value as a guide during this childhood period is unquestioned, for from no other source can so much dependable information be secured, and such information is a tremendous factor in prognosis, especially from the orthodontic point of view. Information obtained through the use of the roentgen rays can become a real factor in preventing malocclusion in some instances.

I have spoken of prevention chiefly as it applies to focal infection and its relation to preventive medicine. Some of us were in practice when the emphasis was altogether on a mechanical basis, but, with further information as a result of

*Read before the Section on Orthodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

the use of the microscope, the roentgen rays, closer clinical observation, dependable case histories, accurate tabulations and reports and more general education of both the profession and the public, this emphasis has been gradually shifted, until today the teaching is largely upon a biologic basis. Health is paramount, and it is the foundation upon which dentistry must be practiced. Teaching is not altogether confined to the schoolroom, for in dentistry, as in other progressive callings, much of our knowledge is obtained after we begin practice. Therefore, one of the greatest problems is to so teach our colleagues who have already spent a number of years in active work that they will become thoroughly imbued with the health value of good dental service.

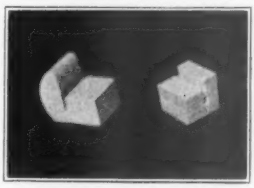


Fig. 1.—Block trimmed down to assist child in retaining holder.

The public is fast becoming informed on oral conditions as a result of the radio broadcasts, the printed page and the dental examination of school children. With an awakened public, we must have an awakened profession to meet the inevitable demands which will come. The demands must be met on the basis of an early diagnosis of dental conditions, with the full appreciation of prevention as it applies to roentgenographic findings.

There has been a very marked improvement in our attitude toward the necessity of eliminating guesswork as nearly as possible in our work, and also in compiling information and histories of cases. Of course, much more must be done and thoroughly done before we can entirely cope with the ever-enlarging responsibilities developed through roentgenographic examination of children. As a profession, we are making progress and many valuable data are available, which are serving as a directing hand. There is room for a more exacting technic which can be uniformly applied for children, but an exacting technic of itself will never take the place of earnest endeavor on the part of the operator. Neither will an exacting technic in radiodontia nor earnest effort by the operator take the place of careful clinical inspection of the oral cavity of every child patient, but as an adjunct the roentgenogram is indispensable. In prevention in children's dentistry, we have the health of the child in mind, of course, but, in most instances, the roentgenographic examinations are made to discover incipient caries and the number of teeth present, and to ascertain the likelihood of irregularity of the teeth themselves, and for the early correction of tendencies toward facial deformities.

Fig. 2.—Holder in position for posterior teeth.

Radiodontia, like every other phase of dentistry, is laborious, and especially so for children. Usually, for roentgenography in primary dentition, some assistance is necessary, but I have found that by using a small wood block as a holder of the film, which gives the child an opportunity to rest the opposing jaw by biting on this holder, little difficulty is encountered. (Figs. 1-2.)

I frequently have the parent assist by standing behind the chair and placing a hand on the child's head after the desired

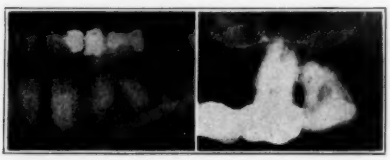


Fig. 3.—Evident arrested development of roots.

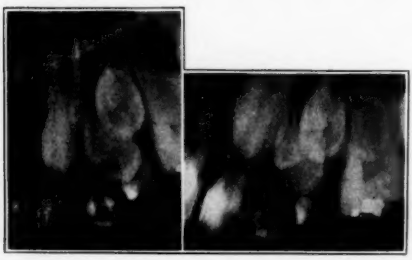


Fig. 4.—Evidence of absence of deciduous molar.

position has been secured. This usually quiets the child and also enables him to hold still for the necessary time. So-called fast films have little place in routine radiodontia, but for children they are of value. Sometimes a film of intermediate speed is used, especially for the maxillary teeth. A slight loss of detail may be had in many such films, but dependable information can be secured. The saving of time, to minimize the chance of movement by the child, is a real factor in good results.

I do not believe it safe practice to attempt orthodontic treatment in any case without a roentgenographic survey. The question is frequently asked: What constitutes an adequate roentgen-ray survey of a child's mouth? The age of the child and the clinical picture, of course, suggest the extent of examination neces-

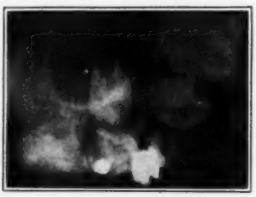


Fig. 5.—Bicuspid in horizontal position, in child, aged 11.

Fig. 6.—Rubber band looped around regular packet.

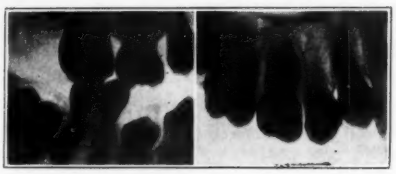


Fig. 7.—Bitewing films, showing more accurately relationship between deciduous and permanent teeth.

sary, but it must be sufficient to account for all the necessary teeth at a given age, and to determine the presence of supernumerary teeth and the relative position of all teeth. If this can be done by using twelve films of regular size, that is sufficient, but usually additional exposures

are necessary in the average case before adequate information can be secured. Sometimes extra-oral exposures are necessary and the so-called occlusal projections may be made.

More detail information is always desirable, such as the length of the roots of teeth to be used to support orthodontic appliances (Fig. 3), the extent of calcification of roots before tooth movement is started, the presence of caries in any of the teeth and also radiodontic findings at a given age, as a matter of record.

the posterior regions. This modified bitewing method is made by using a regular size dental film around which is looped a rubber band near the middle of the packet (Fig. 6). The child is instructed to bite on the rubber band after it has been drawn tightly enough to hold the packet in position during the exposure. The rubber band takes the place of the wing in holding the packet in position. The central ray is directed at right angles to the line of occlusion when the teeth are closed. I have no objection to bite-

Fig. 8.—Case of congenital absence of twenty-two permanent teeth, including four bicuspids.

I know of no disadvantages in using the roentgen rays in children's dentistry, but there are many conditions revealed by their intelligent use; which enables the dentist to perform the maximum service with the minimum discomfort for the child. (Figs. 4-5.) Therefore a thorough and complete radiodontic examination at a given age, say at 8 years, and a routine follow-up examination every year or two with a modified bitewing technic, will afford valuable information, especially in

wing films, but there are advantages in using this method instead of employing the regular bitewing films, in that the films are smaller and more easily placed in a child's mouth, and they are cheaper; we have an extra film as a matter of record (there is but one film in the bitewing packet), and the size conforms to any regular mount for viewing. By this method of checking-up, the progress of tooth movement, either by orthodontic treatment or in the natural process of

dentition, can be recorded, and we have less distortion of the cervical structures and a more accurate relationship between the deciduous and permanent teeth than is usually secured by the regular conventional examination.

Children's dentistry, or pedodontia, is receiving unusual emphasis at present, and courses in the interest of the child are being taught in our leading schools. This indicates an awakening by the profession to this responsibility and the fact that a very definite service can be rendered. In the past, all too frequently the child was brought to the dentist for just one of two reasons: either to be relieved of pain, or to have irregularities of the teeth corrected. Preventive dentistry did not seem to have taken cognizance of the child; but the tide is changing, and recent examinations of school children revealed many startling evidences of dental deficiencies. In the city of St. Louis, a most comprehensive survey of 119,000 children was completed last year and, on clinical inspection alone, 95 per cent were found to be in need of dental attention. These percentages can no doubt be duplicated in every community, and they tell their own story. Had it been possible to further check these clinical findings with a radiodontic survey, considerably more evidence of dental need could have been tabulated. In private practice, as such cases are presented, the use of the roentgenogram is advisable. Guesswork must be discouraged even in pedodontia. Frequently, the roentgen rays reveal congenital absence of teeth (Fig. 8), the presence of supernumerary teeth (Figs. 9-10), the result of premature loss of deciduous or permanent teeth (Figs. 11-12), and too long retention of certain teeth (Fig. 13).

As such conditions affect the develop-

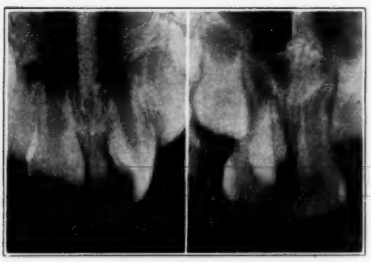


Fig. 9.—Information of value in orthodontics.

Fig. 10.—Impacted central incisors.

Fig. 11.—Result of premature loss of second deciduous molar.

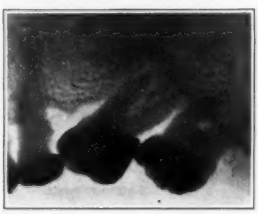


Fig. 12.—Result of premature loss of first permanent molar.

ment of the face and jaws and are usually factors in malocclusion and facial deformities, we owe it to our patients to obtain the best possible information, especially in the case of the child patient. This is absolutely impossible unless we include in our examination a radiodontic picture of the underlying oral structures (Figs. 14-15). As a guide in such cases, the roentgen rays are indispensable.

The influence of focal infection in primary dentition cannot be overlooked. I do not believe it is quite so serious as in the adult, because of the pain and local swelling which usually accompanies infection of the teeth in the child, such local symptoms being frequently absent in the adult. Several factors enter into this difference, the chief of which is lack of previous effort in restorative dentistry for the child.

Fig. 13.—Deciduous molar which has been retained too long.

Fig. 14.—Submerged deciduous second molars.

I have never become enthusiastic about retaining deciduous teeth which have become pulpless as a result of either decay or trauma. There may be instances in which such practices are justifiable, but certainly not in routine care of children's teeth, for when these deciduous teeth become septic, they frequently give rise to symptoms of a systemic nature.

Unfortunately, certain dentists dislike to care for children, probably because, to them, children's dentistry is not remunerative enough to bother with. To a very great extent, this is the dentist's fault. If, by disposition and nature, he is not inclined toward children, he must either lose from his clientele this large group who, in most instances, form his chief source of practice for tomorrow, or he must place them in the hands of one especially skilled in this very exacting work. If giving the child the best means referring him elsewhere for service, it should be done, but I cannot conceive of any dentist's attempting to care for the child without the frequent use of the roentgenogram (Figs. 16-18).

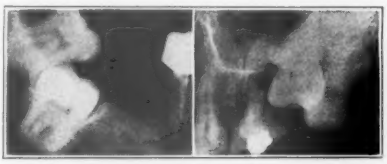


Fig. 15.—Submerged second molars.

Fig. 16.—Dentition at 18 months.

Since the use of the roentgen rays in the average office is becoming quite general, and therefore of necessity the dentist must give his patient the benefit of

the final word in diagnosis, the responsibility cannot be shifted and we must raise the general level of the whole profession. The teaching begins at school, where the student has been given a conception of dentistry as something more than mere repair of lost structures, where the oral cavity as the organ of mastication is related to the whole body in a definite way, and where the integration of the various subjects taught is such

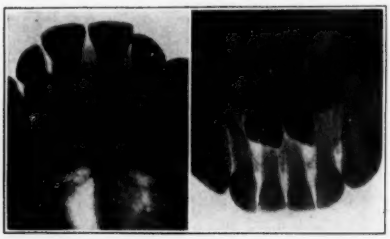


Fig. 17.—Normal dentition at 5½ years.

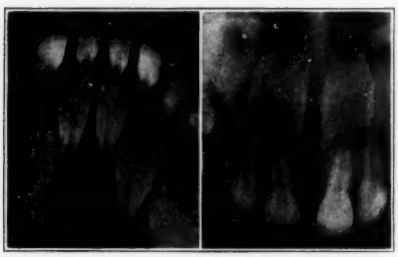


Fig. 18.—Slow development of maxilla and mandible causing irregularity of teeth, in child aged 5½.

as to emphasize fundamentally the importance of diagnosis in a broad sense. This same ideal must be carried over into the practicing profession (Figs. 19-20).

In the realm of medicine, the use of the roentgen rays as a factor in diagnosis is constantly on the increase. Just recently, in the *Journal of Radiology,* it was editorially stated that in a well known medical center, 80 per cent of all patients had some form of roentgen-ray study during their course of physical

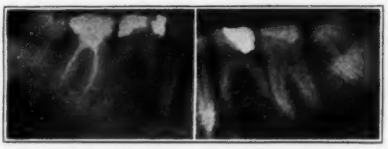


Fig. 19.—Absence of second bicuspids.

Fig. 20.—Lack of absorption of deciduous molar.

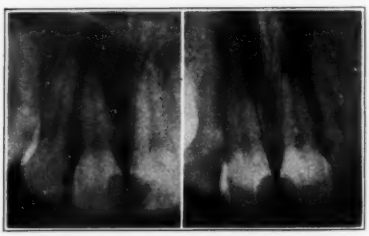


Fig. 21.—Types of restoration that must be used with care, especially for children, to prevent periapical disease.

examination. The public is well advanced in its appreciation of roentgenographic service, and extension of this service to the child for dental information should not be difficult, if we of the profession will visualize the advantages to be gained (Fig. 21).

FOOD IDENTIFICATION*

By ARTHUR L. WALTERS, D.D.S., Tulsa, Okla.

THE following presentation is made primarily for the benefit of numerous members of the dental profession who, while recognizing the importance of diet in today's conduct of a successful dental practice, have neither the time nor the interest necessary for intensive study and investigation of the subject, yet are sincerely desirous of adopting a practical, workable plan of nutrition, especially relevant to problems of dental disease prevention and health.

In past years, the prescribing of a diet (even in cases of dental disease) was anybody's business, but the astounding increase and continued prevalence of caries, pyorrhea and other dental ills evidenced the fact that the dental profession must meet its own problems of therapy and prevention. Improper diet, by indisputable research of the world's most renowned scientists, was indexed a factor no longer to be ignored in oral disease.

Why, then, should not the dentist understand the numerous phases of nutritional measures applicable to dental therapy and prevention?

The masses, now interested in diet and dental care, expect the dentist to care for their mouths and teeth. They come to us: it is our responsibility. True, we may not have the unqualified endorsement and cooperation of the medical profession in certain localities, as yet, nor will we, until we are competent to assume 100 per cent responsibility. Medical men can then no longer feel that we are overstepping our professional bounds, and will turn back to us the responsibility of a problem rightfully ours.

Quoting from the report of the subcommittees in the Professional Education Section of the American Dietetic Association:

Of seventy-one medical schools responding to the questionnaire, only twenty-two offer formal courses in Nutrition and Diet Therapy as a part of the medical curriculum. In only ten of these medical schools were courses in Nutrition obligatory. It is almost universally conceded that the average physician's knowledge of normal nutrition and the method of modifying the normal requirements to meet the needs of the body in disease is extremely limited. We would recommend that these subjects (Nutrition and Diet Therapy) be accorded a more important place in such curricula (medical).

In contradiction of this statement, most dental schools are offering regular courses in nutrition as a part of the school curriculum. Postgraduate courses are offered in their colleges and the programs of dental organizations (local, state and national) show many essayists presenting papers on nutrition and related subjects.

Eating has become a recognized science, based upon common sense. Educators are now giving it a position of importance and the masses are clamoring for guidance in the selection of adequate and healthful daily fare.

The subject of food thus becomes of vital interest to every member of the pro-

*Read before the Section on Partial Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

fession, and those who realize the part that well-balanced diet plays in building, or maintaining, general and oral health will not only obtain all possible information and knowledge, but will also avail themselves of every opportunity to interest and convince those who, at this late date, are either uninterested or still skeptical.

Many doubting patients will need to be convinced, for bad eating habits are insidious and only positive conviction on our part will make it possible for us to promulgate data to aid in the alleviation and cure of dental lesions and in the prevention of further disease.

The capillary circulation nourishing the dental tissues is of greater extent than that in any other part of the body. Many of the earliest deviations from normal health reflect themselves so clearly in changed macroscopic conditions of these tissues that it becomes a part of our program to familiarize ourselves with normal and abnormal dental tissue (gums, alveolar process, teeth, mucosa and salivary glands), in order that early interpretation of many incipient diseases may be made.

The fact that these living dental tissues are, by nature of their abundant circulation, affected by both local and constitutional conditions, or changes, makes nutrition a matter which insistently demands our recognition.

If we assume this dental guardianship, it becomes obligatory that we accept responsibility for early recognition of potential, as well as actual, causes of disease (as related to our particular specialty in medicine) and, further, that we become competent to definitely acquaint the patient with all the facts contingent on his particular case.

Only as far as we accept and carry out this responsibility do we approach the ideal which each strives to attain if he would justify his position as a doctor of dentistry.

Any substance necessary to the development, building or maintenance of the body may, broadly speaking, be classified as a food. The creating and maintaining of physical life requires energy, the main source of this body energy being food. Water, air and sunshine play important parts since they are responsible (directly and indirectly) not only for the creation and maintenance of life, but also for everything having to do with the production of all elements necessary for body nourishment. There are many other factors such as texture, consistency, palatability and digestibility, etc., in food energy or value.

In our discussion of identification of foods, we are interested in those substances designated by the chemist as proteins, fats, carbohydrates (including cellulose), mineral salts and vitamins, identified as such by reason of a preponderance of any given food substance, or because they are dependable sources of that substance, and not because they are wholly one food principle.

PROTEINS

Proteins are classified as such because of their chemical formula. These albuminous, alkaline substances contain carbon, hydrogen and oxygen, and in addition nitrogen (presumably 16 per cent), while some contain sulphur, phosphorus and iron.

Proteins supply the body with nitrogen, sulphur and phosphorus, which, with hydrogen, oxygen and carbon, are the chief chemical elements entering into the composition of the living structures of the body.

The protein molecule is very complex, the ultimate cleavage product being a considerable number of substances which are known to the chemist as amino acids.

More than forty of these acids (only about eighteen of which enter into the body composition) are known. Only when a protein contains all these eighteen amino acids may it be designated a complete protein. Milk, eggs, meat, some nuts and some vegetables contain complete proteins; which means that any of the above mentioned foods is able of itself to furnish the body with every amino acid necessary for bodily growth and repair.

FATS

Fats are neutral substances consisting chiefly of carbon and hydrogen with a small amount of oxygen. The chief sources are: butter, cream, cheese, meat and vegetables.

Fat is produced by the action of the body cells on starch and other carbohydrates. In other words, it can be synthesized by the body; therefore, fat, as such, is not absolutely essential in the diet, but some forms are very desirable, their vitamin content and high caloric food value making them a wholesome and useful constituent of the dietary. They are the most concentrated of all forms of foodstuffs, having an energy value more than double that of proteins or carbohydrates, pure fat supplying 9 calories per gram. Overconsumption of fat may very easily become a dietary problem, especially if combined with underconsumption of carbohydrates.

CARBOHYDRATES

Carbohydrates are neutral compounds composed of carbon, hydrogen and oxygen, the hydrogen and oxygen being present in a proportion to form water.

There are many different kinds of carbohydrates. Those usable by the body are starch, dextrin, the various sugars (cane, malt, milk, dextrose [grape] and levulose [fruit]), fruit acids and cellulose.

Starch, the most abundant of all the carbohydrates and the most important food element, is found in all cereals, unripened fruits, certain nuts and most vegetables (especially legumes).

Dextrin is derived from starch by heating and is practically identical with it in chemical composition. Sugars, also, are derived from starch by heating with dilute acids or ferments.

Of the various vegetable acids, the only ones utilized by the body are citric, malic and tartaric. Oxalic, benzoic and certain other acids (of vegetable origin) are not oxidized or broken up, to any extent, in the body.

As found in vegetable foods, organic acids are in combination with soda or potash, in the form of acid salts. When the acids are burned, or utilized, by the body, the alkaline ash, soda, or potash, is left behind, so that the ultimate effect of the utilizable organic acids is to increase the alkalinity of the vital fluids, and not to acidify them, as many seem to think.

Carbohydrates are derived almost exclusively from vegetable sources. Glycogen is an animal starch produced chiefly by the liver, but in smaller amounts in some organs and tissues (particularly in the embryo, also in some fungi). Milk sugar (or lactose) is another carbohydrate present in milk (separated from the whey by evaporation), but exceedingly rare in the vegetable kingdom.

Carbohydrates are used by the body to maintain animal heat and to supply energy. Every bodily movement involves the burning of carbohydrates, with the human constitution seemingly adapted to a rich carbohydrate dietary. The army, during the World War, used, to the best advantage, a diet consisting of four parts carbohydrate to one part of fat, while adults doing ordinary labor seem to do best on diets consisting of two parts

carbohydrate to one part of fat, with children requiring almost the same proportion as the fighting soldier.

Kellogg says, "A well-balanced diet should contain more than half of its energy value in the form of carbohydrates. Energy in this form is apparently more readily and easily utilized than in any other form. Natural, unrefined sugar is the ideal fuel of the body."

Cellulose is an insoluble carbohydrate substance which forms the framework of plants and plant products. It is not acted on, to any great extent, by the fluids of the human digestive apparatus, although it is digested, to some degree, by herbivorous animals and even constitutes the principal food of certain low forms of animal life. Cellulose is a highly important dietary constituent of human beings, giving the food mass necessary bulk to be grasped and propelled by the intestine, thereby enabling it to move along the alimentary canal at proper speed.

Opinions vary among certain groups as regards the eating of some forms of cellulose (bran in particular). As a result, articles, not only in the various lay magazines, but in the professional journals as well, seem at absolute variance with each other. Rendered doubtful because of the controversy, the reader is often confused as to whether he should eat this most valuable product.

The ancient Hippocrates believed in the use of bran. In one of his medical works, he states, "This I know, moreover, that to the human body it makes a great difference whether the bread be fine or coarse; of wheat with or without the hull."

Recently, the United States Department of Agriculture published the results of experiments made at the New York Experiment Station indicating that wheat bran is laxative not only because of its indigestibility, which makes it a mechanical stimulant of the intestine, but also because of the presence in bran of a peculiar laxative substance, phytin, found in very considerable amount in the outer layers of the envelop. This important discovery furnishes a scientific basis for the regular use of bran as a natural laxative, securing increased bowel activity, not by irritating the bowel as do medical laxatives, but by physiologic stimulation, making its use possible for an indefinite length of time without loss of effect and without injury.

Mary S. Rose and her co-workers at Columbia University say,

> Bran is not coarse fiber—only one tenth of it is. Moisture and bacteria of the human alimentary canal readily soften and convert it into quickly absorbed starches. By weight, bran is two-thirds starch and sugar, one fifth protein, one-twelfth fat; contains iron, phosphorus, lime, and enough vitamin B to rank it high in the list of foods containing this ingredient. Its definite laxative action comparable in efficiency to that of vegetable-fruit paste, milk of magnesia, senna tea, and cascara, is probably due to these constituents, plus crude fiber.

MINERAL SALTS

The mineral salts, calcium, sodium, potassium, magnesium, iodine, iron, copper, phosphorus, sulphur, etc., constitute about 4 per cent of the body weight. These mineral salts are not found in a strictly inorganic form either in the body or in foodstuffs. It is true that chlorine and sodium (in the form of sodium chloride), phosphorus and calcium (in the form of phosphate of lime) are found in small amounts in foods in the inorganic state, but iron, sulphur, phosphorus and calcium, in general, exist only in organic form in the body.

The body loses daily approximately an ounce of these salts (chlorides, sulphates, phosphates and other salts of calcium, magnesium, sodium and potassium), and

since adequate nutrition is dependent on them, the only manner in which this loss may be compensated for is by ingesting at least an equal amount of such salts daily. That this requirement is not being met is evidenced by the prevalence of mineral starvation of children and adults, believed to be a factor in many dental and bodily ills. Pregnant women are starving for calcium. Growing children show its need in rickety bones, malformed jaws and carious teeth. Men and women are dropping out in their prime owing to an insufficiency of calcium in the diet.

The use of more milk and milk products, more whole grain products, less refined sugar and less meat would seem the most practical remedy, but for some reason we are not applying it in proportion to the need.

Milk is not difficult to obtain. Fresh, sweet, sour, buttermilk, evaporated, dried, or powdered, it contains an abundance of the life-sustaining element. In fact, the child or adult, allergic to fresh milk, is often able to use some one or more of these other forms. Nature, with modern refrigeration and transportation, places fresh fruits and vegetables at our very door throughout the whole year. Cauliflower, cabbage, lettuce, spinach—rutabago, carrots, turnips and legumes are all rich in calcium. Yet we starve in the midst of plenty.

Phosphorus is so closely associated with calcium and vitamin D in the development of bones and teeth that I shall name a few of its best sources: milk, lean meat, egg yolk, whole grains, oatmeal, potatoes (outside portion), dried beans, carrots, turnips and nuts.

Iron insufficiency identifies itself with certain forms of nutritional deficiency diseases such as anemia. Whole wheat, oatmeal, beef, liver and kidney, eggs, spinach, green vegetables and legumes, as well as most fruits, contain valuable amounts of iron.

Copper, by recent research, has been found essential to adequate diet, in that it associates itself with iron in blood formation.

Nuts, cereals (wheatgerm, oats, rye, barley), poultry, fish, oysters, animal tissues, roots, vegetables, kidney beans and peas, fresh fruits and dried fruits are all utilizable sources of copper.

We all recognize simple goiter as a result of iodine deficiency, yet an exceptionally small amount meets bodily requirements.

Since the iodine content of food varies greatly with proximity to the sea, it would probably be a wise precaution, in most inland areas, to add small amounts of iodine salt to the diet.

Small amounts of aluminum, manganese and zinc have been found in foods, but as yet have not been proved to be essential to dietary needs.

VITAMINS

Vitamins are subtle substances, other than the food elements mentioned, which are essential to growth, development, good nutrition and resistance to disease. Their purpose, seemingly, is to promote the various functional activities of the body, an insufficiency of vitamins in the diet bringing on varying degrees of malnutrition or definite deficiency ailments.

Vitamin A(fat soluble, anti-infective, resistance building) is one of the main substances protecting against infection (especially of the eyes, ears, nose, throat, lungs, kidneys and skin). Butter, dairy products, liver, green vegetables and cod liver oil are available sources of vitamin A.

Vitamin A is gradually destroyed by exposure to air and by extreme heat, but withstands ordinary cooking temperature.

The human body is capable of storing

vitamin A for future needs. Sherman, in his "Chemistry of Food and Nutrition," says,

> Because the animal body can store vitamin A in relatively much greater proportion than vitamins B or C, and because the effects of a shortage of vitamin A are less specific and more widespread, the results of experiments with vitamin A have in many cases given confusing results or failed of correct interpretation so that the great importance of this vitamin has not been fully appreciated even by many of the investigators themselves. We now have good reason to believe that a surplus of vitamin A in the body is not simply a reserve asset to be used at some future time, but also actively increases the vigor and the ability of the body to resist disease.

Vitamin B (water soluble, antineuritic) protects chiefly the nerve cells and brain structures. Yeast and the germ of wheat, eggs, vegetables, legumes and glandular organs are the chief sources. Cooking and drying materially reduces this vitamin in food, and since it dissolves readily in water, its potency is further diminished if cooking water is discarded; while the addition of soda in cooking utterly destroys it.

Vitamin C (water soluble, antiscorbutic) protects the heart, the blood vessels, blood and other internal parts. It protects the dentin, it, as well as vitamin D, being a factor of dental health. Citrus fruits, tomatoes, green raw vegetables and sprouted grains contain this vitamin. Vitamin C is destroyed by exposure to air, by drying, cooking or canning (except vacuum).

Vitamin D (fat soluble), scarcest of all the vitamins, contributes to the health of the bones and tooth enamel, besides adding an element to the blood which helps resistance to infection. Sunshine and skyshine, ultraviolet rays (either natural or artificial), fish liver oils and fish oils are abundant sources of supply. Vitamin D is not easily affected by the heat.

Vitamin E (fat soluble, antisterility) has to do with reproduction and probably contributes to the red coloring matter of the blood. Green leafy vegetables and whole wheat provide this substance, natural deficiency seldom occurring. Vitamin E is very little affected by cooking.

Vitamin G (water soluble, antipellagra) protects the skin, the gastro-intestinal tract and the brain. It is found in milk, meat, egg yolk, liver, green vegetables, the raw cereal germ, seeds and other foods. It is distributed more widely than any other vitamin, yet a lack of it in the diet produces about half of the cases of insanity and costs thousands of unnecessary lives every year. Vitamin G is stable to cooking temperatures.

With the exception of vitamin D, and, to a much lesser degree, A, there is no need for concern if the diet contains an abundance of raw fruits and leafy green vegetables. McCollum states: "Foodstuffs suitable for human consumption are almost without exception deficient in this substance—only fish eating peoples have secured a fairly liberal supply."

Resort may, and should, be had, either to cod liver or halibut liver oils, or to various other activated substances known to contain an adequate amount of the calcium and phosphorus "helper," vitamin D. Tuna fish, salmon and sardines contain it, but butter and egg yolk are the only common food sources known to furnish an appreciable amount.

VARIABILITY OF FOODS

No discussion of food elements would be complete without consideration of the factors in the variability of the nutritive constituents supplied by certain foods.

Milk is not just milk, eggs just eggs, vegetables just vegetables, and fruits just fruit.

Food valuation of identically named foods is greatly influenced by:

(*a*) The inherent quality of the product, based upon animal or plant breeding.

(*b*) Animal and plant rations.

(*c*) Soil: fertility or depletion; mineral content; moisture content; sunshine; geographic location (iodine content).

(*d*) Freshness.

(*e*) Handling, preparation (raw or cooked, refined or unrefined).

Too often these factors are overlooked in "food economics."

Sherman says, in his revised edition of "Chemistry of Food and Nutrition," "Economics knows the price but not the value."

Cost cannot be the deciding factor in food selection, for, in many families, much more than adequate amounts are spent for food without resultant good health, vitality and resistance. Definite knowledge of food values and essential food requirements, discrimination in choice, or selection, of adequate foods, as well as scientific elimination of foods not ranking high in such requirements, are factors of utmost importance. Advertisements should not be relied on as a test of food value. Only the results of experimental research are to be accepted as authoritative.

An adequate food supply not only furnishes energy and provides for growth and repair, but also maintains health and builds resistance to disease.

James A. Tobey, in his essay on "Nutrition and Nerves" in *Scribner's,* April, 1930, says, "We are learning that (given a normal animal to start with) a diet which is health sustaining and disease resisting, promotes physical, mental and spiritual developments."

Many philosophers have held body, mind and soul to be interdependent, and modern science recognizes the importance of proper food, fresh air, sunlight and environment on health and behavior.

A serene, keen mentality, with highly developed ideals, is rarely found in an undernourished, toxin-loaded, pain-racked body.

Good nutrition is associated with steady nerves and normal behavior; malnutrition, constipation and indigestion, being associated with nervousness, irritability, fag, fearfulness, and finally dullness, and even instability of the nervous system.

BALANCED RATION

The balanced, or physiologic ration, is one which furnishes adequate, as well as properly proportioned, amounts of protein, carbohydrates, fats, mineral salts, water and vitamins. But the protein must be complete, the carbohydrates of the right kind (natural or unrefined and with sufficient cellulose content), the mineral salts almost wholly organic and the ration supplemented by adequate amounts of the necessary food factors, vitamins.

In the balancing of meals, food choosing habits are of great importance. Childhood is the proper time for intelligent supervision. There is no logical necessity for the choice of foods being restricted, and the possible variety limited, because of strong likes or dislikes (either in children or adults), for certain foods. Most all foods may be liked if care is used in their preparation, combination, proportion and frequency of appearance in the diet. Taste is not a fair test of food value, but is much too often allowed to be a deciding factor.

Eating for health conservation has much to combat in the way of pernicious eating habits, whims and fads.

Diets are often improper rather than truly insufficient or inadequate, especially where cost is not a contributing or recognizable factor.

END-PRODUCT

The average meal composed of meat, potatoes, bread, or cereals, salad, coffee, etc., may provide some of every one of the five food principles, and yet the final product may be a relatively high acid ash to be neutralized by the body.

When the dietary contains the minimum or no meat protein, and an abundance of raw fruit and vegetables is used, little or no concern need be given to the acid-base balance; but when the meals are composed largely of bread or cereals, meat, refined sugar, tea and coffee, as is too frequently the case, it becomes imperative to give serious consideration to this phase of the question.

With the exception of the perspiration, urine and gastric and colonic secretions, all secretions should normally be neutral, or alkaline, in reaction. As a matter of exact truth, health and life are dependent on the normal alkalinity of these fluids. Any deviation from the normal alkalinity means a relative, or true, acidosis, with all that such a condition entails. Hence, it becomes necessary to think not only of food principles, but also of the kind of ash left by these food principles.

Under normal conditions, sugars, starches, fats and a great portion of the proteins burn to carbonic acid, which is eliminated by normal respiration and has no effect on the alkaline balance, if promptly eliminated.

With very few exceptions, there is always an ash left after the food has been burned or oxidized in the body, and on the character of this ash depends the acid base balance of the fluids in which all the cells are bathed. This ash is nonrespirable, is neutral, alkaline or acid, and is eliminated chiefly by the kidneys.

Butter, cream, lard, cornstarch, sugar and tapioca are listed in tabulations of Sherman and Gettler as neutral ash foods.

Generally speaking, all vegetables, milk, nuts and fruits (with the exception of prunes, cranberries and plums) are alkaline in their final reaction, dried lima beans, 41.65 points alkaline, heading the list, with dried beans and raisins next. Lima beans are tabulated the most alkaline food known. Potatoes, beans, asparagus, muskmelon, oranges, apples and bananas are all known as especially efficacious in reducing urine acidity.

Meat, fowl, game, oysters, fish, eggs, cereals and their products, are all in the acid ash group, with oysters, chicken and egg yolk highest in the list.

In formulating diets or building food menus, reduction of income only increases the importance of nutrition. Reducing the food budget without endangering nutrition, and adjusting this more limited diet to meet individual problems of age, health and occupation, creates a problem of extensive interest today.

Whatever the food budget, the best possible plan consists in spending as large a proportion as possible for milk, milk products, whole grain cereals, fruits and vegetables, milk being the surest protection against nutritional deficiency (of bone, muscle and teeth).

Minimum food essentials for a family should include:

Milk, a quart a day for children and a pint a day for adults.

Vegetables, two, besides potatoes, every day.

Fruit, raw or cooked, some daily. Tomatoes may replace citrus fruits.

Eggs (fresh), a minimum of three or four a week, one daily, if possible.

Cereals or bread, preferably whole grain.

Additional proteins: meat, fish, cheese, nuts, dried peas and beans.

Fats, butter, lard, side meat, bacon, vegetable oils and margarine.

Sweets, sugar, honey and molasses.

Limited diets are of necessity uninteresting and monotonous, and because of this, less appetizing, so with increased income, the quantity of the protective foods should be increased rather than meats and fats. Let the difference in meat be in more expensive cuts (giving more variety), rather than in the amount consumed.

ONES DAY'S BALANCED MENU FOR FAMILY OF FIVE

The family consists of the father (doing moderate day labor), the mother, a child of preschool age, a child of early school age and a girl of 'teen age. The food budget for the week is limited to $6.75.

Breakfast

Whole wheat cereal (cooked)
Milk and sugar
Scrambled eggs
Whole wheat toast (buttered)
Milk for children
Coffee for adults

Lunch or Supper

Fresh or canned tomatoes with cottage cheese
Boiled potatoes (cooked with jackets)
Whole wheat or rye bread and butter
Milk for all

Dinner

Baked stuffed heart (using potato and bread crumbs)
Buttered onions
Spinach or other greens
Raw carrot and raisin salad (served on cabbage or lettuce leaf)
Corn muffins (freshly ground whole corn) and butter
Gingerbread

ONE DAY'S BALANCED MENU—COST NOT A CONSIDERABLE FACTOR

Breakfast

Cantaloupe or honeydew melon—oranges or grapefruit
Fish croquettes
Whole wheat muffins, butter, orange marmalade
Milk for children
Coffee for adults

Lunch

Tomato juice cocktail, whole wheat wafer, ripe olives
Artichokes
Green beans
Pineapple and cream cheese salad on shredded lettuce
Whole-grain rye bread with butter
Iced cocoa for all

Dinner

Cream of celery and lima bean soup, croutons
Beef tenderloin with mushrooms
Baked potato
Swiss chard
Endive and cucumber salad (lemon juice French dressing)
Raisin bran bread with butter.
Iced watermelon and fruit punch

Conclusions drawn from scientific data indicate that while general health is influenced by local and environmental conditions, the same local, or environmental, conditions are wholly, or in part, induced by a lowered resistance having its origin in a deficiency diet, or in some unnatural method of living.

Nutritional deficiencies are manifestly responsible for deviations from the normal in general health, and these deviations will also, in time, express themselves in some form of dental disease.

There can be no such thing as a constitutional impairment which will not ultimately be reflected in the oral cavity. Oral health is wholly dependent on general health.

Wynwood Reade says: "The folly of dividing the diseases of such organs as the head and the stomach, between which the most intimate sympathy exists, is evident to the unlearned."

Inherent weakness of any organ of the body may be helped or overcome by close observance of the nutritional needs of the body as a whole. In fact, this is the most worth while and dependable ally at our command.

AMERICAN FOUNDATIONS AND DENTAL PUBLIC HEALTH

By J. A. SALZMANN, D.D.S., and HARRY STRUSSER, D.D.S., New York City

THE growth of dentistry as a public health factor is evidenced in the increased interest shown this profession by philanthropic agencies and foundations. The amount of money appropriated for dental health service, considering the fact that from 96 to 98 per cent of the child population of the country is suffering from dental disease, is altogether insufficient and bears no equitable relationship to the total funds appropriated for medicine and public health in general. The same holds true for dental college endowments when compared with endowments for medical colleges.

In an article published in 1931,[1] it was pointed out that only four dental schools out of forty-six in existence in 1920 had any income from endowment, the total amount at that time being $41,520. Of this sum, Pennsylvania received $25,000; Harvard, $10,420; Columbia, $6,000, and Pittsburgh, $100. It was not until 1927, when Northwestern University received the Montgomery Ward bequest, that the annual income from endowments of all dental schools in the United States reached $100,000. In 1930, the total amount of all income from endowments for all dental schools in the country was $136,540, Pennsylvania, Northwestern and Harvard sharing $129,765 among them, while five other schools divided the remaining $6,775. Thirty of the thirty-eight dental schools had no income from endowments up to that year. With the advent of the economic depression, income from endowments of dental schools has decreased considerably. In contradistinction to the dearth of dental college endowments, there are over thirty endowed medical schools. Harvard and Johns Hopkins medical schools receive annually over $500,000 each. Seven medical colleges each receive more income from endowments than all of the dental schools in the United States combined.

The *Journal of the American Medical Association* publishes weekly a list of the bequests made by charitable persons toward the advancement of medicine and for the maintenance of hospitals. We have been following these lists for a number of years, to see how many of the bequests are made in behalf of dental colleges, for dental research, or for other purposes that would tend to advance dental public health. To date, with one or two notable exceptions, we have found but very few isolated and minor contributions for dental purposes. Furthermore, the few bequests made were usually not presented to any specific dental college, but rather to special groups for the study of specific subjects, such as the Bolton Study for child growth and development, the Children's Fund of Michigan and the Kellogg Foundation. It is a peculiar fact that such institutions as the Eastman Clinic in Rochester, the Guggenheim Dental Clinic in New York and the Samuels

1. Salzmann, J. A.: Economic Status of Dental College Faculties, J.A.D.A., 19:2281-2290 (Dec.) 1931.

Clinic in Rhode Island, all endowed institutions, were established independently and not as departments of dental colleges.

In order to determine further the extent to which American foundations are interested in advancing dental public health, the accompanying questionnaire was sent to foundations which had in the past made contributions to public health work in the form of child welfare, medicine and public health or social welfare.

QUESTIONNAIRE SENT TO AMERICAN FOUNDATIONS

Dear Sirs:

We are engaged in a survey of Foundations and other agencies that have contributed to the advancement of Dentistry and the promotion of Dental Public Health. We should therefore appreciate it greatly if you would furnish us with any of the following information:

Have you in the past, or are you at present contributing to

1. Dental clinics.....
   Direct maintenance.....
   Financial support.....
2. Dental health education.....
   A. Distribution of dental health literature .....
   B. Financing dental radio talks.....
   C. Providing instruction in dental hygiene .....
3. Grants to Dental Colleges.....
   A. Dental scholarships.....
   B. Fellowships .....
4. Dental research.....
5. Any other efforts tending to advance dental health.....
   .....

Very truly yours,
J. A. SALZMANN, D.D.S.
HARRY STRUSSER, D.D.S.

For the purpose of this study, foundations were defined as organizations whose function it is to disburse funds in the operation of their own activities or through grants to outside beneficiaries, or both. We have endeavored to avoid listing those foundations which, obviously, have no interest in public health in any form. The term "child welfare" as used here includes all endeavor in the promotion of welfare of children except child health, which is classified under medicine and public health. This division does not include grants for education.

The twenty largest American Foundations[2] had in 1931 a total capital of $725,559,829. Of these, eight foundations together possessed 69.7 per cent of the total wealth. The first three, comprising the Carnegie Foundation of New York, the Rockefeller Foundation and the General Education Board, had 46 per cent of the total wealth among them. According to geographic distribution, 78.9 per cent of the capital was concentrated in New York City, which is the center of fifty-two foundations.

Medicine and public health received in 1931 a total of $18,627,222, or 35.5 per cent of the grants made to the various fields. Of the amount granted to medicine and public health, $8,396,932 was spent for education; $8,401,825, for social action, with funds donated to hospitals, clinics and public health work, and $1,128,458 for research. Total grants for child welfare amounted to $1,215,258.

Of total grants, amounting to $18,627,223 for medicine and public health, $16,509,734 went for general purposes. Only $81,176 of the latter amount, less than one-half of 1 per cent, was given for dental health endeavor. Grants for dental health purposes in 1931 were made by the Carnegie Foundation to the amount of $6,250; Children's Fund of Michigan, $70,985, and the Rockefeller Foundation, $3,943; in all, $81,178. In a list of sixty-one specific and varied fields for which grants were made, dentistry stands forty-eighth, while medicine and public health in general stand first.

The data in the accompanying table are

2. American Foundations and Their Fields, published by the Twentieth Century Fund, 1931.

EXTENT OF ACTIVITIES AND GRANTS FOR CHILD WELFARE, MEDICINE AND PUBLIC HEALTH AND DENTISTRY MADE BY AMERICAN FOUNDATIONS IN 1931

	1*		2†			3‡			4#	5§	Child Welfare	Medicine & Public Health	Dentistry
	a	b	a	b	c	a	b	c					
American Foundation for Mental Hygiene												$ 55,000	
William F. Becker Trust												4,500	
Bemis-Taylor Foundation											$ 7,500	17,025	
Bolton Fund			Yes						Yes				
Brush Foundation										Yes			
Buffalo Foundation										Yes	15,700	7,179	
Buhl Foundation												199,200	
Burke Foundation												5,000	
California Community Foundation											1,200	2,400	
Carnegie Corporation						$80,000			$105,000			93,750	
Carnegie Foundation for the Advancement of Teaching									Yes	Yes			$ 6,250
Chicago Community Trust		Yes									5,422	27,951	
Children's Fund of Michigan	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes	30,050	126,665	70,985
Children's Hospital Research Fund of Cincinnati	Yes												
Cleveland Foundation											13,647	11,715	

Committee of the Permanent Charity Fund, Inc.		Yes									$ 20,650	$ 71,800	
Commonwealth Fund												1,621,320	
Dayton Foundation		Yes									1,294		
Detroit Community Trust	Yes												
Duke Endowment											117,691	1,070,474	
General Education Board												1,395,520	Nothing
Golden Rule Foundation		Yes									109,648	7,397	
D. & F. Guggenheim Foundation											12,540	36,244	
M. & L. Guggenheim Foundation	Yes				Yes				Yes			707,158	
Harmon Foundation						Yes							
Edward W. Hazen Foundation											450	29,533	
Baron D. Hirsch Fund											25,023		
Nathan Hofheimer Foundation											2,600	76,325	
Jarvie Commonwealth Fund		Yes											
Arthur Jordan Foundation												400	
W. K. Kellogg Foundation		Yes	Yes		Yes	Yes				Yes			
Julius Littauer Foundation											2,747	162,172	
Josiah Macy, Jr. Foundation												36,900	
Milbank Memorial Fund												795,281	

EXTENT OF ACTIVITIES AND GRANTS FOR CHILD WELFARE, MEDICINE AND PUBLIC HEALTH AND DENTISTRY MADE BY AMERICAN FOUNDATIONS IN 1931—CONTINUED

	1* a	1* b	2† a	2† b	2† c	3‡ a	3‡ b	3‡ c	4#	5§	Child Welfare	Medicine & Public Health	Dentistry
Milwaukee Foundation											$ 3,100	$ 300	
New Haven Foundation												5,029	
New York Community Trust											8,271	68,560	
New York Foundation		$2,000										30,300	
Estate of La Verne Noyes							Yes						
J. C. Penney Foundation												12,790	
Permanent Committee Trust Fund of Oklahoma											5,000		
Phelps-Stokes Fund											200	1,000	
Rockefeller Foundation											621,681	10,965,039	
Julius Rosenwald Fund		Yes									11,202	620,389	
Russell Sage Foundation											20,000	25,000	
Leopold Schepp Foundation												15,000	
Charlotte R. Schmidlapp Fund		Yes											
Spelman Fund											83,735		
Hattie M. Strong Foundation						Yes							
Thomas Thompson Trust		Yes	Yes		Yes					Yes	500	49,828	

John Edgar Thomson Foundation	Yes										92,453	9,201		
Twentieth Century Fund												$ 12,392		
George Robert White Fund												144,301		
Wieboldt Foundation											$ 5,900	8,300		
Amherst H. Wilder Charity											21,868	94,999		
Williamsport Foundation											200	2,885		
Thomas Thompson Trust		Yes	Yes	Yes					Yes	500		49,828		

*a, direct maintenance; b, financial support.
†a, distribution of dental health literature; b, financing of radio talks; c, instruction in dental hygiene.
‡a, grant to dental colleges; b, dental scholarships; c, fellowship.
#Dental research.
§Any other efforts for dental health.

based on replies received to the questionnaire.

SUMMARY

The following summary shows the extent of the activities of the various foundations in dental public health:

Buffalo Foundation, Buffalo, N. Y.—In answer to our inquiry as to whether any efforts tending to advance dental public health were made by this foundation, we received the following reply:

"Have had representation on several local committees to promote dental hygiene in public schools and for better service to children in dental clinics, but have not donated funds nor have we been asked for funds for dental services."

The Bolton Study, Cleveland, Ohio.—This undertaking is connected with the Anatomical Laboratory, School of Medicine, Western Reserve University, Cleveland. The Bolton Study is devoted to developmental studies of the face of the growing child, B. Holly Broadbent, director.

Carnegie Corporation, New York City.—This foundation made the following grants for research and study in dentistry:

1923-1924, California Stomatological Research Group, University of California, $85,000; 1927-1928, California Stomatological Research Group, University of California, $20,000; 1928-1929, college and university dental school libraries: United States, $50,000; Canada, $4,000; total, $54,000; 1929-1930, American Association of Dental Schools, $20,000; 1932-1933, American Association of Dental Schools, $10,000; total, $189,000.

This foundation has materially aided in the advancement of dental education, notably through the publication of Bulletin No. 19 by William J. Gies, in 1926. A grant of $17,500 was made in 1935 to

Yale University to continue the dental research project started in 1929 under a grant of the Rockefeller Foundation.

Children's Fund of Michigan, Detroit, Mich.—A series of dental clinics are conducted for the children of the State of Michigan.

Children's Hospital Research Foundation, Cincinnati, Ohio.—This foundation contributes to the maintenance of a dental clinic and employs a dental intern.

Chicago Community Trust, Chicago, Ill.—The Chicago Community Trust has not directly made any contribution to public dental health. The Emergency Welfare Fund of Chicago, to which the Community Trust contributes, is giving about $20,000 this year (1933) for the maintenance of dental clinics. In addition, the Fund has helped the clinics to get an allocation from the Illinois Emergency Relief Commission. The funds thus obtained provide the entire financial support for clinics. The members of the dental society contribute their services gratis.

Committee of the Permanent Charity Fund, Inc., Boston, Mass.—This agency pays for orthodontic treatment performed at Harvard University for patients who cannot pay the usual private fees. Up to July 1933, more than $1,100 was expended for this purpose.

Dayton Foundation, Dayton, Ohio.—This foundation has in the past contributed to the support of dental clinics, but has discontinued this practice.

Detroit Community Trust, Detroit, Mich.—The net income of the Couzens Loan Fund for the Physically Handicapped, amounting to about $8,750 a year, is being paid, under directions of the donor, to the Michigan Hospital Schools for orthodontic work among children. The fund is a part of the Detroit Community Trust.

Golden Rule Foundation, New York City.—This foundation makes grants-in-aid to existing agencies for various types of educational, welfare and relief work, particularly among children. The only record of expenditures allocated by this foundation for dentistry is taken from the report of the Friends of Mountain Children Committee, an administrative agency for the Appalachian and Ozark Mountains. This committee reports that approximately $350 of the total 1932 grant from the Golden Rule Foundation was spent on dental service, largely to individual mountain children.

Harmon Foundation, Inc., New York City.—The only connection this organization has with the field of dentistry is through the Division of Student Loans, which is an experimental activity. A considerable number of students in dentistry have been on their loan lists.

Jarvie Commonwealth Fund, New York City.—This fund pays the bills of a number of beneficiaries who have work done at a "pay clinic."

W. K. Kellogg Foundation, Battle Creek, Mich.—This foundation has made grants for dental purposes as follows:

1. In rural schools which they have assisted in building, they have included a health unit which is composed of a medical department, a dental department, a classroom for teaching health education, retiring rooms, etc. The dental health unit is supported and maintained by the W. K. Kellogg Foundation. There are five health units in operation at the present time.

2. (*a*) They distribute some dental health literature to groups, usually after a health talk has been given.

(*b*) In the territory in which this foundation operates, health education, including dental hygiene, is taught, by teacher-nurses, who have an academic degree as well as their nursing degree and

have had special work in health education.

3. They are conducting postgraduate courses for the dentists in the communities in which they are operating, but are not assisting in the financing of any dental colleges.

New York Foundation, New York City.—The New York Foundation gave the sum of $2,000 in 1923 to the Allied Dental Clinics, Inc. (since discontinued).

Estate of La Verne Noyes, Chicago, Ill.—This fund provides scholarships in the entire field of learning, including dentistry, medicine and public health, to U. S. War Veterans and their descendants.

The Rockefeller Foundation, New York City.—In the field of public health, the Rockefeller Foundation has specialized on certain diseases, such as hookworm, malaria and yellow fever, and only incidentally has aided an occasional project in dentistry. From their annual reports, we gleaned the following items: $2,500 to N. Y. Training School for Dental Hygienists (later Vanderbilt School of Dental Hygiene, Columbia University), toward the salary of the director, 1916; $120,000 to Yale University Medical School toward research in dental pathology for the period Jan. 1, 1929-June 30, 1934; $88,040 to University of Rochester, N. Y., School of Medicine and Dentistry, toward research in dental pathology, over the period of May 1, 1929-December 31, 1933; fellowships for four Chinese and one Czechoslovakian student in dental hygiene. In addition, the International Health Division has aided a number of health units, especially in Europe, which engage in dental work as one of their routine activities.

Schmidlapp Fund, Cincinnati, Ohio.—This fund supports the Shoemaker Health Center, which has a dental clinic.

Hattie M. Strong Foundation, Washington, D. C.—This foundation has aided many students of dentistry financially, enabling them to complete their studies.

Thomas Thompson Trust, Boston, Mass.—The work of the Thomas Thompson Trust with reference to dentistry in connection with the promotion of public health has embraced most of Wyndham County and southeastern Vermont, with a population of about 26,000.

The work was begun several years ago when physical examination was made of more than 2,000 school children in the district. It was found that they left school handicapped by numerous physical defects. A large portion of these handicaps were directly or indirectly attributed to defective teeth. Children of the more remote districts showed especially bad dental conditions, many never having had their mouths examined. As a rule, nothing was done about the teeth until, owing to neglect, they had to be extracted. The first dental hygienist has now been employed for several years. Her work consists in visiting the children in the schools, cleaning teeth, giving children and their parents talks on dental hygiene and general hygiene, and arranging for the employment of dentists to treat poor children.

A second hygienist has worked chiefly in Brattleboro, Vt., in cooperation with the rural school nurse working in the county at large and with the town school nurse in Brattleboro proper, the work being under the general service office.

In consulting with the local dentists, two main principles seem to have been evolved with the idea of eventually turning out school children with reasonably sound teeth as part of a proper life equipment, embodying instruction in the rules of health and care of the body for preserving health. The first principle was to put the stress of the dental work on the early grades on the ground that prevention is better than palliation. The second lay in

the manner of making use of dentists. These men were willing to do charitable work, but were evidently not enthusiastic about buying dental equipment for free clinics when they had their own equipment to do the work and were willing to help. The plan was worked out by referring children to their family dentists when possible and having the work done by them on the general assumption that the responsibility lay with the parents and family dentist. In some cases of isolated towns where there were no dentists, the work was contracted for and done in quantity by younger dentists. This created an entirely new field of dental work. The general method was to work in connection with the parent-teacher associations and to get the individual communities to arrange for a general clean-up of disabilities and to match money raised locally for what is called the "children's repair fund," the chief work being as usual with the teeth and diseased throats.

The salaries and traveling expenses of the dental hygienists are being paid by the Thompson Trust. The full cooperation of the teachers and school superintendents has been an essential element and has resulted in numerous school rooms and small schools getting trophies for clean bills of health and in considerably reducing the bad dental conditions in the two largest towns, with substantial progress in the farming townships. In a few cases, clean bills of health have been obtained in some of the rural towns where dental work had been previously almost unknown.

This work has produced no complaints from the dentists as to interference with the integrity of their individual practice. To the contrary, the Fund has received the best possible cooperation from them.

The trustees have very positive opinions as to the undesirability of undermining responsible personal family practice in either medicine or dentistry or pauperizing dentistry, as has often happened with other lines of medicine through charitable endowments as commonly used in small communities.

John Edgar Thomson Foundation, Philadelphia, Pa.—This foundation provides for semi-annual attention to children under its supervision.

August H. Wilder Foundation, St. Paul, Minn.—This foundation maintains a free dental clinic.

CONCLUSIONS

This study does not include foundations whose activities are confined to the operation of dental clinics, such as the Murry and Leonie Guggenheim Foundation, the Eastman, the Samuels, the Forsyth and the White. We wished merely to show the extent of financial support given dental public health endeavor by American Foundations.

The paucity of grants for dental health purposes is perhaps due to the fact that the subject of dental public health is not fully understood by the profession itself. Few dental colleges at present include it in their curriculums. It should be recognized that the public health problem in dentistry is not merely a question of tooth brushing, or even frequent visits to the dentist. The dental public health problem requires a broad vision. It must be considered as a social problem.

Almost an entire year has been added to the general average life expectancy during the past ten years through the reduction in the incidence of tuberculosis. This would never have materialized if antituberculosis propaganda had been pursued solely as the work of organized medicine. The National Tuberculosis Association, a voluntary and nonofficial health agency, organized in 1904, has done more to reduce tuberculosis than medicine itself could ever have done. Cer-

tainly, dental decay, while perhaps not so directly responsible for a high death rate as is tuberculosis, is still important enough to warrant the establishment of an active, independent agency for the advancement of dental public health. Such an agency must be endowed and should operate on a national basis with local branches. Everywhere, it should receive the endorsement and cooperation of the dental profession. Furthermore, persons trained in dental public health should be employed to outline a plan for the conduct of the work and to interest philanthropic organizations to endow dental health endeavors. A new trail in dental public health must be blazed. Every municipality should have its oral hygiene council, composed of civic leaders, health and educational authorities and interested laymen representing all walks of life. A permanent personnel should be developed under a director whose function it should be to further dental public health.

While the dental profession must take an active part in inaugurating and carrying on this work, dental public health should be made the joint concern of the public and the profession. Neither can successfully solve the problem without the cooperation of the other.

576 Fifth Avenue.

SOCIALIZATION AS VIEWED BY THE RECENT GRADUATE

By IRWIN WALTER SCOPP, B.S., D.D.S., New York City

THERE has been an abundance of expression and of material on the prevailing ignorance of the young dental practitioner regarding economics. Similarly, volumes have been hashed and rehashed, repeated and revamped, often being altered only slightly from the original, on the subject of state medicine and dentistry; so much so, as a matter of fact, that the habitual and even the most scrupulous reader of dental periodicals often avoids articles on health insurance or state dentistry, convinced that the subject has been badly abused in the literature. Nothing appears of the attitude of the recent graduate toward social legislation of this sort.

From the outset, let it be made clear that the young dental graduate is well aware and clearly apprehensive of the difficulties in practice. As a matter of fact, it is the exception for one to graduate with the illusion that as soon as he begins practice, the millennium will be realized and all roads will lead to his office. To fully appreciate this attitude, one need only see the mad scramble made by the graduating class to get internships, or to note how envious one graduate is when he learns that another has a salaried position. This reluctance at being thrust into the world is witnessed in our sister profession of medicine to an even greater extent. Here, it is common practice for the graduate to sign up for two and three year internships and then even seek to renew them.

It is not at all surprising, therefore, that the recent graduate looks with hope toward health insurance. Augmenting this attitude is the fact, as all those associated with the newer generation will at-

test, that the younger men are inclined to be socialistic and liberal; whereas, the older practitioner may believe in the *status quo,* since he has always been under that prevailing system and is accustomed to it. We younger men take a more objective point of view. We are convinced that when 80 per cent of the population is not getting adequate dental care, a change in system is mandatory.

Actually, on scouring the European systems, we find no basis for advocating health insurance. There has never been a health insurance scheme in vogue which was not inaugurated by political expediency; there has never been a health insurance scheme that was adequate either professionally or economically; there has never been a large health insurance plan in which the administrative officials did not outnumber the doctors; there has been no health insurance scheme in which the standard of professional service was high or was satisfactory; there has never been a health insurance scheme which insured such a distribution of medical service as to make it available to every one; there has never been anything but dissatisfaction on the part of the insurance doctors and the insured public in any existing large scheme.

Why, then, does the young graduate advocate such plans? Why does one get married when so many divorces are evident? Why does one start a business with bankruptcies so prevalent? Why does a surgeon operate in cases of malignancy? The answer to all these questions lies in one word: Hope.

Youth lives in hope. Were it not for this intangible but yet definite factor in our plans, we would indeed be distressed. We have hopes that a better system of health insurance may be evolved. What we lack in practical experience and knowledge, we make up in hope. In times such as these, to be sure, we are far better equipped than the older experienced practitioner.

Unfortunately, we will not have a voice in shaping legislation for health insurance, in spite of the fact that we will be most affected by any system and for the greatest length of time. All committees shaping health insurance plans are made up of men at least twenty years in practice. Can they present our point of view? Have they not already made a muddle of things?

So it is with the recent graduate—he is definitely confused; but indeed not so confused as the older and experienced men of the profession. The younger man is willing to try a new system; the older men are sitting back hoping that St. Peter will do something.

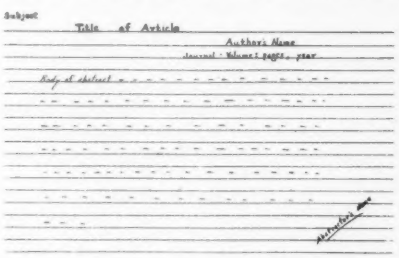
ABSTRACTING PERIODICAL LITERATURE ON DENTISTRY*

By HAMILTON ROBINSON, D.D.S.,† Rochester, N. Y.

DENTISTRY'S literature has grown within a century from a few scattered articles to a mass of material carried in more than a hundred dental journals and in various medical and technical science journals. There was a time when the student of dental science could cover the periodical literature himself, but that period is long past. To cover even a single phase of dental literature for a year would call for the greater part of one's time. How, then, is the dentist to keep abreast of the new developments in his science?

Abstracts of articles are of undoubted value. A number of abstracts can be read in a comparatively short time and then selected articles can be studied more carefully from their original sources. Dentistry expects to have an abstract journal of its own. In fact, the American College of Dentists approved the creation of *Dental Abstracts* some time ago. In the meantime, much valuable material can be passed by. Under the section "Current Literature," THE JOURNAL is publishing a restricted number of abstracts and reviews which dentistry can well afford to note.

The dental group at the School of Medicine and Dentistry, University of Rochester, several months ago determined to abstract articles of dental interest from a selected number of medical journals. The idea was an extension of a plan used by the *Penn Dental Journal* at the University of Pennsylvania, where one of the members of the group had seen it worked out. Each member of the group was given the names of four or five periodicals to look over each issue. The abstracts made were recorded on 5 by 8 inch filing cards and, after being read to the group at one of the biweekly seminars, placed on file. A few of these abstracts were sent to the Editor of THE JOURNAL, who accepted them so graciously that it was decided to systematize and extend the program. Each of the six Rockefeller Fellows in Dentistry comprising the group is associated with a medical department; i.e., anatomy, bacteriology, biochemistry or pathology. Each Fellow elected to cover from four to seven periodicals in a scientific field related to his department or in general medicine. In this way, thirty-four journals are being abstracted by the group and the abstracts kept on file, copies being forwarded to THE JOURNAL.



Filing card on which abstracts are recorded.

*From the Department of Pathology, School of Medicine and Dentistry, University of Rochester.

†Rockefeller Fellow in Dentistry.

The periodicals being abstracted and the names of the abstractors are given in the accompanying tabulation.

Basil G. Bibby, L.D.S.		**Bacteriology**
Journal of Experimental Medicine	Monthly	
Journal of Bacteriology	Monthly	
Journal of Immunology	Monthly	
Journal of Infectious Diseases	Bimonthly	
Journal of Pathology & Bacteriology	Bimonthly	
British Medical Journal	Weekly	
Harold C. Hodge, Ph.D.		**Biochemistry**
Biochemical Journal	Bimonthly	
Journal of Biochemistry	Bimonthly	
Journal of Biological Chemistry	Monthly	
Journal of Nutrition	Bimonthly	
Grant Van Huysen, D.D.S.		**Pathology**
American Journal of Clinical Pathology	Bimonthly	
American Journal of Roentgenology	Monthly	
Radiology	Monthly	
British Journal of Experimental Pathology	Bimonthly	
Journal of Bone and Joint Surgery	Quarterly	
Alton D. Brashear, D.D.S.		**Anatomy**
American Journal of Anatomy	Bimonthly	
Anatomical Record	Monthly	
Journal of Anatomy	Quarterly	
Journal of Comparative Neurology	Bimonthly	
American Journal of Physical Anthropology	Quarterly	
American Journal of Surgery	Monthly	
Maynard K. Hine, D.D.S.		**Bacteriology**
American Journal of Cancer	Monthly	
American Journal of Diseases of Children	Monthly	
British Journal of Diseases in Children	Quarterly	
British Journal of Anesthesia	Quarterly	
Lancet	Weekly	
American Journal of Hygiene	Bimonthly	
Hamilton Robinson, D.D.S.		**Pathology**
Journal of American Medical Association	Weekly	
American Journal of Pathology	Bimonthly	
Annals of Surgery	Monthly	
Proceedings Royal Society—B.	Monthly	
Archives of Pathology	Monthly	
New England Journal of Medicine	Weekly	
Yale Journal of Biology	Bimonthly	

A program such as this can be readily molded for use by other research or study groups or dental societies. There are innumerable dental, medical and basic science journals in different languages containing valuable articles of interest to dentists. Any group undertaking such a study should take precautions against overloading. The form for the filing cards adopted by the group is rather simple. The abstracts should give the essence of the article without going too much into detail of method or technic. Abstracting is "the summing up of the main points of a larger work," while reviewing is the writing a "critical notice" of a work. If the abstractor remembers these definitions, he will pick out the important points and not insert his own criticisms. More than mere looking through the table of contents will be

found necessary in selecting articles of dental interest, for many interesting sidelights on dentistry are found in nondental periodicals under nondental titles.

The abstractor benefits in more ways than one: He feels obligated to cover literature that he might glance over; he gets the point of view of authors who are not dentists and he learns to pick out the important points of an article.

HISTORY AND DEVELOPMENT OF DENTISTRY IN MEXICO*

By HORACE G. WHITTLESEY, D.D.S., Mexico City, Mexico

THE history and development of dentistry in Mexico is a vast subject, reaching into prehistoric times and covering the life of man from the most remote times up to the present. Treatment of such a subject, even superficially, in the forty minutes allowed, must necessarily be only a "hop, skip and a jump."

In the earliest mythology of the ancient Mexican races, both the predecessors and the contemporaries of the Aztecs, who spoke the common Nahuatl language, there were special gods called *Tlan qui ce mil,* "those who tighten the teeth in one day." These little gods, fleet-of-foot and tireless, were the assistants of the great god Quetzacoatl, the Plumed Serpent, and came to the relief of human beings suffering, evidently, from pyorrhea, and, by closing their mouths for one entire day, denying them speech, food or drink, cured them and made firm their teeth.

Written history tells us that caries, or decay of the teeth, was known to the ancient Mexicans by the name *Tlan palan al iztli,* a formidable looking word, but a very clever and comprehensive one. Each of the five syllables is equal to a word, the whole telling quite a story, as was always the case in the expressive Nahuatl nomenclature, indicating that *Tlan,* the teeth, when decayed, were treated with medicinal herbs which grew near the water and furthermore that the crude instrument of dental surgery was made of sharp edged volcanic glass, or obsidian.

The germ which caused the disease was *Tlan a cuil in,* or the tooth-worm.

Decay of the teeth was treated with the herb *tle patli,* the syllable, *patli* always indicating that the herb had medicinal value. (Botanically, it is *Plumbago scandens Linn.)* Taken as a drink in water, it relieved pain. Chile (Mexican pepper) masticated, let us hope by the patient himself, was applied to the decay and the cavity filled with a concoction of powdered snail, salt from the sea and tobacco *(tlal ca ca oatl).*

The therapeutic measures, according to ancient chronicles, were many and excellent, always relieving pain. The treatment was to puncture, or lance, the gums and immediately apply: leaves of *achiotl (Hern Bixa arrellana);* ashes of the leaves of the *tempixquiztli;* leaves of the *yoyotli* (cascabel); tobacco leaves; the root of *quimich patli;* powder of the flowers of *cocoyxtli;* powder of *aloltic;* a piece of the root of the *tlancoch patli,* whose name signifies tooth medicines, and

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

which to this day is sold in the market places in the City of Mexico; juice of the leaves of the same plant; juice of the herb *xocotlato;* juice of *quamochitl;* flowers of the *paton mexixquilitl,* our old friend the nasturtium, mashed and mixed with alum, which had a very potent sedative effect; flowers and leaves mashed and distilled with alum cured ulcers; root of *chilmecatl* (herb of the solanaceas, or night shade family), the root, resembling rope, or mecate, and hence the name. When applied to aching teeth, this cured pain in a manner that was regarded as miraculous.

All these remedies applied locally in the cavities of decayed teeth relieved pain and formed a rich arsenal of defense against further disease, leaving nothing unfortified.

Fig. 1.—Cast gold teeth used as center piece of necklace. Both have one vertical groove. Eight other cast gold pieces represent the teeth of carnivorous animals. This, an example of the Mixteca culture, was found in Ojitlan, Oaxaca.

Fracture of the teeth was called *tlan cal on al iztli.*

People who had teeth missing were referred to as *tlan tepenh qui* because of the whistling sound which they made when they talked.

Gingivitis had probably the most amazing names, three of them, and which would appear to be worse than that disease itself. *Que quet al inh qui, Que quet o le a izle* and *Que quet ol pach inh qui.* The treatment was a gargle made of: the juice of the *tla chi chi no ax thu itl* (something bitter as indicated by the syllables *chi chi,* which in the Nahuatl tongue is bitter); botanically a plant classified as *Tournefortea Mexicana cervantesii;* the juice of *tian quez pe petla;* a macerated piece of *tezca patli* (senecio precox); the juice of the fruit of *ya man ca patli;* pulverized root of the *tla tlanh ca patli,* and a piece of the root of *Ca ma to ton ca patli,* herbs of the native doctors, which alleviated the inflammation and pain and made firm the teeth.

Fig. 2.—Breast-plate of cast gold probably representing Mictlante Culti, the God of Death. The inferior maxillary bone formed a mask for the buccal portion of the figure, which belongs to the Mixteca culture and was found in the famous tomb No. 7 at Monte Alban, Oaxaca.

No reference is made to pink tooth brush, though brushes were used, being improvised from the chips of the *Can u ga (Avizena Rorbe, aromatico),* being frayed for the purpose.

Dentifrices were not unknown to the ancient Mexicans. They were made from the powder of the leaves of *Coz tic patli,*

macerated bark of *Tez ca patli,* and the year old seed of the *nopal* (cactus), called *nopal noch iztli,* ground up and wet with the sap of the tree called *tez hu atl* (the suffix making known that it was especially rich in sap or water), to which

Fig. 3.—Figure made of baked clay, Tarascan culture, state of Michoacan. The Tarascan culture is a continuation of the ancient culture of the Valley of Mexico. The swelling indicates the presence of abscessed teeth.

Fig. 4.—Funeral urn—baked clay—Zapoteca culture found in tomb 32 of Monte Alban. It represents the Goddess of Corn. Note the preparations for incrustations.

alum was added, the whole being made into cakes and dried. These cakes, moistened with vinegar, scoured the teeth and made them remarkably white, as well as acting as an astringent.

In the second year of his reign, Moctezuma, the Emperor of the Aztecs, sent ambassadors, bearing gifts to Malinal, king of a friendly tribe of a province near Oaxaca, with a message saying that he, Moctezuma, desired a certain tree which grew in the gardens of Malinal, called *tla pal iz quix och itl,* which bore

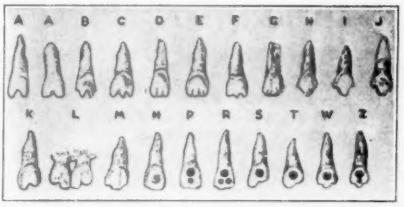


Fig. 5.—Types of mutilation and incrustation.

Fig. 6.—Old Man God—the God of Fire. His Zapoteca name is not known, but he represents the same functions as Xolotl of the Valley of Mexico culture. He is here represented on a funeral urn. Elongated and missing teeth may be noted.

beautiful flowers. In exchange for this tree, Moctezuma offered to give Malinal anything he would ask. But Malinal dared to refuse the request and paid for it dearly, as Moctezuma, greatly enraged,

dispatched an armed force, and in the battle that ensued, Malinal was killed. The victorious army returned to the Aztec capital bearing the coveted tree and a goodly number of captives.

Interesting, too, that the tree of the sweet smelling and beautiful flowers, *Bourreria huanita* of the *Ebenaceas* family, was for centuries esteemed for its medicinal virtues, and its flowers were of fabulous value and, because of their astringent properties, were used to tighten the teeth.

Fig. 7.—Maxilla found without incrustations (adult Tacolpa, State of Vera Cruz).

Fig. 8.—Maxilla found in Cholula, state of Puebla, pre-Spanish. An alveolar abscess of the right superior central incisor goes to prove that even ancient Mexicans had some of the modern ills.

The early Spanish historians say that when the Conquerors came to Mexico City, they were greatly surprised to find in the Royal Gardens of Moctezuma, grouped in the order of the families they resembled, species and varieties, the native plants of the country, medicinal and otherwise, and, in Tlaltoloco, native doctors, skilled in the art of cures with herbs, the first discoverers of medicine, who left to posterity a rich materia medica.

Fig. 9.—Above: Right superior cuspid, adult, found in tomb No. 43, Monte Alban; upper central incisor; upper central incisor with inlay of hematite. Center: Left cuspid from tomb No. 34, Monte Alban; cuspid also found in tomb No. 34; upper central incisor from tomb No. 18. Below: upper central incisor from tomb No. 10; upper central incisor from tomb No. 10.

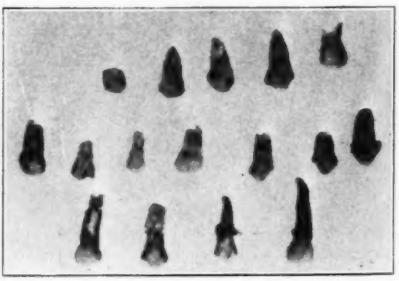


Fig. 10.—Mutilated teeth found buried in upper part of pyramid of Cholula, near Puebla.

The first university on the North American Continent was founded in Mexico City in 1554, but its teachings were principally religious, courses in medicine not being offered until 1580. Almost 200 years later (1768), a school of surgery was established with courses taught in Spanish instead of Latin.

As in the old world at this period in history, the phlebotomists (leeches) and barbers were the exodontists. The former were the lowest in the scale of surgery, after a three years' apprenticeship appearing before an examining board and on the payment of 25 centavos and showing a christening certificate and proof of a moral life, being licensed to extract teeth. The barbers had to pass an examination showing knowledge of arteries and veins, blood letting and extractions in order to work at their trade. As the centuries passed, the only changes arising were in the costs of examinations, which soared from 25 centavos to more than 150 pesos. In the War of Independence, the university was occupied by revolutionary soldiers and later closed by presidential decree. The school of medicine moved to San Ildefonso. A department of public education was initiated. The present school of medicine was opened in 1833, with teaching differing little from that of Spanish colonial times, with no specialization, doctors, surgeons, leeches, pharmacists, obstetricians and dentists studying the same courses.

By 1845, the medical school started giving examinations for license to practice dentistry. The candidate must have

Fig. 11.—Teeth from Jacona and Tangancicuara (Maya culture).

Fig. 12.—Mexican gods from Barbonico Codex.

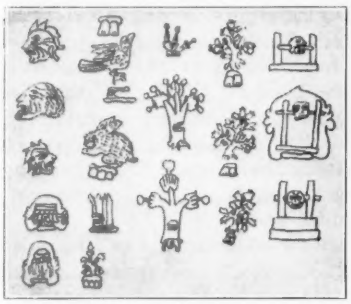


Fig. 13.—Hieroglyphs of Aztec names of towns. The teeth represent syllable tlan.

Fig. 14.—Hieroglyphs making use of teeth.

had a certificate from a practicing dentist stating that he had performed all operations. The examining board was composed of five physicians and the examination consisted of diseases of the mouth. During this time, only seven dentists were licensed, these being mostly foreign. The year 1900 saw the suspension of this system, and 1904 the founding of the first dental school, a branch of the medical school, which was called the Consultorio Dental, Anexo al Escuela de Medicina.

In 1910, Justo Sierra founded the present school, called Facultad Odontologica, which was, and is, separate from the school of medicine. Requirements for matriculation are a B.S. or a corresponding degree, as in dental colleges in the United States.

It is a far cry from a modern porcelain jacket crown to an obsidian inlay in a cuspid of a prehistoric superior maxilla in the Puebla Museum, a specimen which first aroused my interest in the subject, and furnished the stimulus for much fascinating research in the line of incrustation and mutilation of the teeth of the ancient Mexicans, eventually leading me to Dr. de la Borbolla, head of the Department of Anthropology of the National Museum in Mexico City, who answered my question as to this particular skull No. 180. It is, he says, a type of incrustation characteristic of the Mayas and foreign to the locality in which it was found.

Through the courtesy of Dr. Alfonso Caso, director of the National Museum, and Dr. Daniel Rubin de la Borbolla, I have brought to this convention projections of photographs of veritable treasures disinterred from these Zapotecan and other ancient tombs, invaluable to the anthropologist in his study of the races and of great interest to the dental profession.

Dr. de la Borbolla was good enough to give to me much that has been discovered only recently, material from the manuscript of his, as yet, unpublished book.

He has, up to date, found twenty types of incrustation and mutilation. These incrustations were not used in the preservation of the teeth, but purely for adornment, as shown in the fact that they have never been found in other than the anterior teeth.

The stones and metals employed as inlays were: obsidian, jadite, turquoise, iron or hematite, as gold, as yet found only in Ecuador and Peru.

The cement was possibly a paste made of seeds of Alegría mixed with resinous sap of copal, or huisache.

There were several popular designs for filing the teeth: those of wedge-shape, like a swallow's tail, with a serrated edge and others, as can be seen in the accompanying illustrations.

Old women were the interior decorators, Dr. de la Borbolla says, doing the filing, probably, with some kind of hard stone wet with water.

Funeral urns have been found bearing, if not the ear-marks, the tooth-marks of distinction.

I previously mentioned incrustation and mutilation of the teeth of human beings. The gods of the ancient people of Mexico were their heroes in life, who when they died were deified and considered to have only awakened from the dream called life. There are certain distinguishing characteristics about the pictured and sculptured gods, among them, not unimportant by any means, the manner in which their teeth were filed.

In picture writing of the Nahua language, many hieroglyphics represented syllables, the syllable *tlan* being represented by a maxilla with two or more teeth. *Petatlan,* represented by the syl-

lable *petlatl, de petate,* pictured woven palm leaves, used on the floor or for a cape, and a maxilla with two teeth, each tooth with two vertical grooves. Dr. de la Borbolla admitted to me that these grooves might possibly have been an attempt to imitate nature in the beginning, but that they apparently also had a meaning. If there exists another relation in the idea that these mutilations represented in the hieroglyphics, it is rather vague and not yet proved. *Mixtlan* was represented by *mixtli,* cloud, and a maxilla with two central incisors each with two vertical grooves; *atlan,* a symbol of water and two teeth each with one vertical groove. *Tlantl,* which presents one or two vertical grooves in the teeth, serves to complete the termination *tlan,* "close by" or "in."

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THE PROSTHODONTIST'S INTEREST IN THE MINERALIZATION AND DEMINERALIZATION OF BONE*

By BOYD S. GARDNER, D.D.S., Rochester, Minn.

REFERRING to the pathology of calcification and ossification, Jones and Roberts have said:

The problems of bone growth have for many years attracted the attention of physiologists, anatomists, and biochemists, and many controversies have centered on the nature of the osteoblast and the osteoclast, the function of the periosteum, the chemical constitution of the bone salt, and the factors determining the deposition of this salt in the skeletal framework. To the clinician and the surgeon these problems have appeared to be chiefly of academic interest, and in no other branch of medicine has there been more confused thought, more inaccurate observation and more unsound teaching, than in the clinical pathology of ossification, calcification, and decalcification of tissues. Bone formation has been attributed to the specific activity of osteoblasts, despite the fact that bone may develop in tissues far distant from any possible source of osteoblasts. The deposition of calcium in abnormal situations has not been correlated with the deposition of calcium in normal bone, and special theories have been formulated to account for it. No clinical distinction has been clearly established between destruction of bone and simple decalcification. The association of decalcification of bone with the hyperemia of infection has been accepted, but the same decalcification arising after fracture of the neck of the femur and leading to non-union has been attributed to impairment of the blood-supply. An identical pathological

*From the Section on Dental Surgery, the Mayo Clinic.

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

entity has therefore been attributed to exactly opposite pathological processes.

Although experimental observation is still incomplete, the work which is already established is sufficient to enunciate principles of the most vital clinical significance. The osteoblast can no longer be regarded as a cell endowed with the specific power of laying down bone. It is merely the cell of a mesenchymatous tissue in which inorganic salts may be deposited, absorbed, re-deposited, and re-absorbed according to the local influence of enzymes and under the general control of endocrines. This is not a property peculiar to bone cells. A similar power to effect the deposition of inorganic salts is possessed at certain stages of development by the cells of cartilage and of fibrous tissue. The bone cell has no more specific power than the cartilage cell or the fibrous-tissue cell and in fact all of these cells are of the same type. The osteoblast is a fibroblast enlarged because it is active. Any of these tissues, after preliminary de-differentiation to the state of primitive mesenchyme, may be built up again in the form of one of the other tissues. When the endocrine balance is disturbed as in hyperparathyroidism skeletal bone may be de-differentiated only to appear as fibrous tissue. On the other hand, in myositis progressiva, the fibrous tissue of tendons and muscles is de-differentiated and built up again as bone.[1]

These authors have referred to the interest shown in this subject by physiologists, anatomists and biochemists. It seems that it is of equal interest to any dentist who is interested in changes in bone.

Reference to cellular change can well be made more interesting by referring to examination of the periosteum in aged patients. Fibroblasts alone may be found, but as the periosteum becomes injured, the fibroblasts change to osteoblasts as repair starts.

1. Jones, R. W., and Roberts, R. E.: Calcification, Decalcification and Ossification, Brit. J. Surg., 21:461-499 (Jan.) 1934.

Proper denture exercise makes for a lessened blood supply, with resulting deposition of mineral salts. The intake of minerals also should be sufficient. This result can be observed by careful roentgenographic examination of the bone which supports teeth before their extraction, and by reexamination at certain intervals after insertion of dentures.

A similar condition is noted in the bone that supports teeth which have been subjected to a great amount of work, as seen in the chewer of tobacco. This is the type of bone that makes a better and more lasting foundation for dentures, provided, of course, the dentures are so built as to give proper exercise. Another provision is that the necessary minerals and vitamins be included in the food intake of the patient. It is obvious that such results cannot obtain if the patient has some endocrine disturbance that interferes with mineral metabolism.

Discrepancies in exposing and developing films can make follow-up roentgenologic examinations worthless for proving that mineralization and demineralization actually take place, but, with the Austin penetrometer, accurate and valuable data are obtained, as an index is established by exposing the penetrometer simultaneously with the tissues under examination.

When teeth that are held with well mineralized bone are extracted, there is little hemorrhage. The opposite is true if the supporting bone is demineralized. In such conditions, lack of exercise is found, with resultant demineralization, and consequently a more profuse blood supply. This condition is encountered when the alveolar crests are trimmed after extraction of teeth of patients who have pyorrhea. The oral surgeon is handicapped by hemorrhage, especially in removal of small apices.

It is not uncommon in such cases to

observe blood spurting from a small artery when the alveolar process is cut, but healing in such cases takes place much more quickly than when the bone is of the opposite type. This same condition of bone is found among young people who are undergoing orthodontic treatment, if it is found that the teeth move with great ease. Here again, lack of exercise, or some endocrine disturbance, results in an increase in the blood supply. With orthodontic appliances, there is likely to be less exercise, because the appliances themselves do not encourage the child to masticate to the desired degree. Furthermore, there is less exercise because the teeth being moved are more tender.

This condition is accentuated when one appreciates that a large percentage of children need orthodontic treatment because they are suffering from demineralization, the result of an inadequate intake of minerals, or an inability to metabolize. Orthodontists report that, in such a condition, the teeth rapidly drift back to their original position, even though the retaining appliances have been in place more than the usual time.

It would seem, therefore, that patients who are undergoing orthodontic treatment should be encouraged to exercise the jaws more after teeth are once removed in order that the desired results may be obtained. Moreover, retaining appliances should be so constructed as not to interfere with mastication.

This relationship of exercise to mineralization can be illustrated by referring to the work of the orthopedic surgeons. They observe that if the arm and hand are put in a splint, and exercise of these parts is diminished, the mineral salts start moving out of the bones to such an extent that the process can easily be shown by the roentgen rays, with the resulting increase in blood supply. When the splint is removed and the arm and hand are put back to work, the mineral salts will soon return. In other words, a physiologic action takes place wherein mineral salts are taken from the bones in one part of the body, when not needed, to another part.

The same phenomenon of disuse is recognized roentgenographically in dentistry, when fixed bridges are removed and replaced by removable bridges. Also, the condition is demonstrated by patients who have a habit of chewing entirely on one side. This condition is referred to as use and disuse atrophy.

In studying bone, especially that of the mandible, one must appreciate that the roentgen rays are directed through both outer and inner cortical layers as well as through the spongy and cancellous portions. It must be appreciated, on viewing roentgenologic evidence, that not planes, but solids, are being dealt with. Dentists must train themselves so that they see the third dimension. To illustrate this, my associate, Dr. Mitchell, has made sections of the mandible so that a study can be made of either cortical portion or the spongy portion, or any combination of the three parts. This study has been of great aid in roentgenographic diagnosis, as it impresses on the diagnostician the need of studying more carefully the relationship of the roots of teeth to the different portions of the bone. In other words, it has important anatomic significance.

The roentgenologist must interpret demineralization as evidence of an increase in the blood supply, and increased mineralization as evidence of a decrease in the blood supply. This may be somewhat confusing when one is taught that by exercise more blood is brought to a part, but such confusion is cleared up when one appreciates that it is the blood stream that is the carrier of min-

eral salts, and only by exercise will the deposition of salts take place. So, primarily, there must be a blood supply to start such a phenomenon, and the blood supply is naturally diminished as bone becomes well mineralized. In osteitis fibrosa cystica, when the bone is rapidly disappearing, as one would expect, the blood is supersaturated with the mineral salts.

It might be well to remind the reader that about two thirds of bone is inorganic and one third organic. When reference is made to mineralization and demineralization, one is dealing with the inorganic portion; while in ossification the organic phase is under consideration.

Diabetic patients constitute a group which is of exceptional interest to the prosthodontist, as constant medical cooperation is needed to maintain the foundation for dentures. It seems that a large percentage of this group are found to be deficient in calcium and phosphorus, as well as in vitamin D. Perhaps this condition is best accounted for by the fact that the physician has directed his attention to keeping the urine of these patients sugar-free and has overlooked the dental condition. Pyorrhea in diabetic patients does not respond well to local treatment alone. The alveolar crests disappear early, and many times the periodontist is confronted with the progressive type of pyorrhea, even among younger patients. In this group, the prosthodontist experiences difficulty in maintaining foundations unless the urine is kept sugar-free, the mineral and the vitamin intake is adequate and the maxilla and mandible are well exercised. The dentist will find that all diabetic patients are unusually concerned about diet and are most willing to cooperate.

Grafts are seldom used in fractures of the maxilla and mandible, but the experience gained by the use of bone grafts in other regions will be of interest to anyone who is interested in changes in bone. A bone graft serves as an inner splint and is the carrier of mineral salts to the site of fracture, although in the majority of cases very little of the salts is utilized. In preparation for the use of a graft, the sclerosed bone is cut away from the distal and proximal ends to insure a better blood supply. The sclerosed bone is produced by inflammation, caused by the reaction of the tissues to bacterial invasion or to trauma, or both. This same condition is referred to as condensing osteitis around the radiolucent areas at the root ends of certain teeth. In experimental work by Ghormley[2] on animals, grafts that were demineralized gave evidence of decidedly more active production of new bone around both the cortical and the cancellous portions. This is obviously due to such a graft's being more vascular.

I refer to sclerosis of bone as the result of pathologic mineralization. It occurs where there has been inflammatory interference with the circulation. In the maxilla and mandible, the sclerotic bone in itself probably causes little if any injury. It is the cause of the ischemia that results in sclerosis of bone which interests the roentgenologist. Is there a residual area of infection? Is surgical interference indicated? A residual area of infection is many times difficult to demonstrate by use of the roentgen rays, but if such bone was formed by inflammation, as a reaction to bacterial invasion, one is more suspicious that a residual area of infection is present. I refer to bacterial invasion, as the hyperemia may be infective or traumatic in origin. This has been

2. Ghormley, R. K., and Stuck, W. G.: Study of Experimental Bone Transplantation with Special Reference to Effect of "Decalcification," Proc. Staff Meet. Mayo Clin., 8:253-254 (April 26) 1933.

stressed by Wisoff[3] and can best be understood by referring to "the rabbit behind the stump." We do not know what is on the other side until we look around, and it is with difficulty that roentgen rays, even though the films were exposed by rays directed from many angles, disclose the true condition.

I believe that we can refer to bone pain or bone discomfort, when bone is exercised after a long period of rest. If a patient is bedridden for many months, disuse muscular atrophy of course takes place, but there is reason to believe that the discomfort experienced by such a patient when first he attempts to walk or stand is not muscular alone, but of the bone as well. The same may be true in the case in which prosthodontia is required. There may be disuse atrophy of the muscles of mastication, so that when the patient first attempts to masticate some hard substance with his new dentures, he experiences pain. Such discomfort may be the result of the weakened condition of the jaw bones rather than of a condition of muscles only.

The possibility of supplying minerals from an inorganic source adds encouragement to the belief in reenforcement of diet by the prescribing of calcium phosphate. Many dentists have found that reenforcement invites more cooperation than when a change in diet is suggested. To many patients, a change in diet alone is not of sufficient importance. The dentist has emphasized to his patient that pyorrhea and caries are symptoms of mineral imbalance, and a prescription, obviously, has more weight than the suggestion that certain foods be taken. Thus, better results are obtained, and with less effort. Furthermore, it is much easier to see that patients are supplied with vitamin D in the form of cod liver oil, or cod liver concentrate tablets than that they receive the required amount of sunshine. Moreover, with the cod liver oil in either form, vitamin A is also supplied, and one is dealing with a tried and proven article.

3. Wisoff, Julius: Residual Infection and Condensing Osteitis; Their Relation to Metastatic Disease and Their Surgical Management, D. Items Int., 53:929-941 (Dec.) 1931.

SOME OBSERVATIONS ON THE p_H VALUES OF CERTAIN DENTIFRICES UNDER VARYING CONDITIONS*

By HAROLD L. HANSEN, Ph.D., and LEONARD S. FOSDICK, Ph.D., Chicago, Ill.

PROBABLY the most widely accepted theory as to the etiology of dental caries is the chemical-parasitic theory, though some phases of this theory have no satisfactory background of either clinical or experimental facts. On the other hand, there are other theories that have the ardent support of groups either in or outside the dental profession, such as those propounded by investigators in the nutritional field. In such a situation, it must be clear that there can be no general agreement as to the methods and the agents recommended for the prevention

*From the Chemistry Department, Northwestern University Dental School.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

of dental caries and that these methods and agents must be characterized chiefly by their diversity. This difference of opinion is well shown in a review by Hyde.[1]

Although it is impossible to classify dentifrices adequately, they may be roughly placed in two groups: the alkaline and the acid. The literature on these two types of products is so voluminous and confused that it is impossible to give a review here. The trends of thought

Table 1.—*p*H Values for Dentifrices and for Mixtures of Dentifrices with Saliva and with Water

Dentifrice	*p*H	*p*H of a 1 to 4 mixture with water	*p*H of a 1 to 4 mixture with saliva
Bost paste	8.3	9.45	8.4
Colgate's paste	8.3	9.9	8.0
Detoxol paste	7.4	8.8	7.6
Forhan's paste	8.2	8.4	7.5
Iodent paste	8.6	9.3	8.1
Ipana paste	8.2	9.9	9.2
Kolynos paste	7.8	9.8	8.8
Lactona paste	4.0	5.8	6.25 to 5.3
Listerine paste	3.8	5.0	6.50
Norsiko paste	3.8	3.6	3.9
Pebeco paste	7.3	8.3	7.4
Pepsodent paste	3.7	6.1	6.4
Pycopé powder		7.4	7.4
Revelation powder		8.6	8.4
Squibb paste	8.4	9.9	7.3 to 8.0
West paste	8.0	9.5	8.2
Worcester salt paste	7.9	9.1	7.9

Table 2.—The *p*H Values of Dentifrices with Varying Amounts of Saliva

Per Cent Dentifrice	100	83.3	71.4	62.5	55.5	45.5	38.5	33.3	29.4	23.8	20.0
Bost paste	7.7	7.7	8.2	8.4	8.7	8.6	8.7	8.5	8.4	8.3	8.4
Colgate's paste	8.4	8.5	8.4	8.6	8.4	8.3	8.3	8.3	8.3	8.3	8.4
Detoxol paste	7.4	8.2	8.1	7.8	7.9	7.9	7.9	7.9	7.8	7.8	7.8
Forhan's paste	8.2	7.8	8.2	8.1	8.0	7.8	7.8	7.8	7.7	7.7	7.6
Iodent paste	8.6	8.3	8.0	8.3	8.3	8.2	8.2	8.1	7.9	7.7	7.6
Ipana paste	8.2	9.3	9.3	9.3	9.2	9.2	9.2	9.2	9.2	9.3	9.3
Kolynos paste	7.5	7.6	7.8	8.2	8.4	8.4	8.7	8.7	8.7	8.8	8.9
Lactona paste	4.3	4.6	5.2	5.2	5.2	4.8	5.0	5.1	5.2	5.3	5.5
Listerine paste	3.8	5.2	5.6	5.5	5.7	5.8	5.8	6.0	5.9	5.9	6.2
Norsiko paste	3.8	4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Pebeco paste	7.2	7.2	7.2	7.4	7.4	7.3	7.3	7.2	7.3	7.2	7.2
Pepsodent paste	4.7	5.4	5.4	5.5	5.6	5.8	5.8	5.8	5.9	6.0	6.3
Pycopé powder					7.2	7.0	7.1	7.1	7.1	7.1	7.1
Revelation powder					7.7	8.3	8.5	8.7	8.7	8.7	8.7
Squibb paste	8.4	8.4	8.2	7.7	7.5	7.5	7.6	7.4	7.4	7.3	7.4
West paste	9.0	8.9	9.0	8.9	8.9	8.6	8.6	8.5	8.4	8.4	8.2
Worcester salt paste	7.8	7.3	7.3	7.2	7.2	7.3	7.0	7.5	7.5	7.6	7.4

1. Hyde, Walter: Dentifrices, J.A.D.A., 18:526 (March) 1931.

may be obtained from the writings of Gies[2] and Pickerill[3] on acid preparations and from the works of Feirer and Leonard[4] and Kells[5] on alkaline dentifrices. Some arguments in favor of the use of soaps in dentifrices are given by Brody.[6]

In the face of so much variation in opinion on the problem of dentifrices, it seems appropriate to obtain basic data on the chemical and physical natures of these products. Information of this type has been given by Ray and Chaden[7] in a study of the abrasive properties of tooth pastes and by Gordon and Shand[8] in some work on surface tension.

Regardless of theoretical discussions as to the proper nature of a dentifrice, it may be assumed that substances which vary widely in p_H have different actions in the mouth. In order to make available information on the acidity and alkalinity of various trademarked dentifrices, it seemed advisable to determine the p_H value of the dentifrices alone and also to investigate the p_H value of these materials under conditions which resemble those occurring during use. The data thus made available enable the practitioner to follow the course of reaction of a tooth paste during use and to choose the tooth paste which best coincides with his ideas of a proper dentifrice.

Owing to the buffering action of saliva and other conditions such as variation in its rate of flow, it is difficult to obtain accurate data on the p_H variations of saliva dentifrice mixtures under conditions comparable to those which arise during the use of the dentifrice. For that

TABLE 3.—THE p_H DEVELOPED IN ONE MINUTE OF BRUSHING

Dentifrice	p_H
Ipana paste	8.1
Listerine paste	6.6
West paste	8.0
Norsiko paste	4.3
Pebeco paste	7.4
Detoxol paste	7.3
Iodent No. 1 paste	7.7
Best paste	8.2
Kolynos paste	8.3
Worcester salt paste	7.8
Forhan's paste	7.1
Pepsodent paste	6.5
Lactona paste	6.0
Revelation powder	7.7
Pycopé powder	8.4

TABLE 4.—MEAN VALUES OBTAINED AT DEFINITE INTERVALS IN BRUSHING THE TEETH

Dentifrice	p_H at end of 15 seconds	p_H at end of 45 seconds	p_H at end of 1 minute 45 seconds
Norsiko paste	4.12	4.14	4.24
Lactona paste	5.64	5.68	7.0
Pepsodent paste	5.96	6.32	7.6
Squibb paste	7.8	8.2	8.2
Ipana paste	8.25	8.15	7.8
Colgate's paste	8.3	7.9	7.7

2. Gies, W. J.: Dentifrice Problem, J.N.D.A., 8:851 (Oct.) 1921.

3. Pickerill, H. P.: Prevention of Dental Caries and Oral Sepsis, Ed. 3, New York: P. B. Hoeber, Inc., 1924.

4. Feirer, W. A., and Leonard, Veader: Antisepsis in Hygiene of Teeth and Gums, J.A.D.A., 14:1049 (June) 1927.

5. Kells, C. E.: Question of Dentifrices, J.N.D.A., 8:609 (Aug.) 1921.

6. Brody, Herman: D. Cosmos, 67:948 (Oct.) 1925.

7. Ray, K. W., and Chaden, H. C.: D. Cosmos, 75:1070 (Nov.) 1933.

8. Gordon, S. M., and Shand, E. W.: Ind. & Eng. Chem., 24:1148 (Oct.) 1932.

reason, a series of different types of experiments were performed in this work in the hope that a combination of values may be helpful in arriving at a fairly definite conception of the range of p_H values produced when the teeth are brushed by a given preparation.

(Before entering on a discussion of experimental work, it may be well to recall the meaning of certain of the terms employed in this work. The symbol "p_H" refers to the hydrogen ion concentration and, in a certain sense, to the degree of alkalinity and acidity. A p_H value of 7 represents a neutral solution. Any value below 7 indicates an acid solution; and any value above 7, a basic solution. Figure 1 may be helpful in relating the p_H

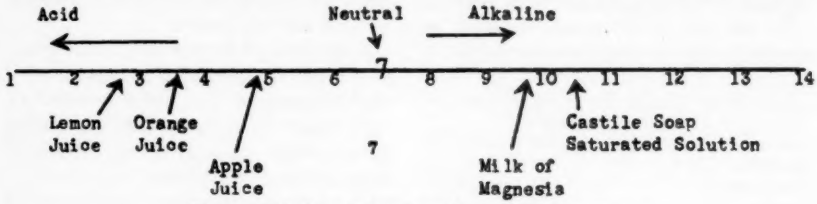


Fig. 1.—Relation of p_H to certain common substances.

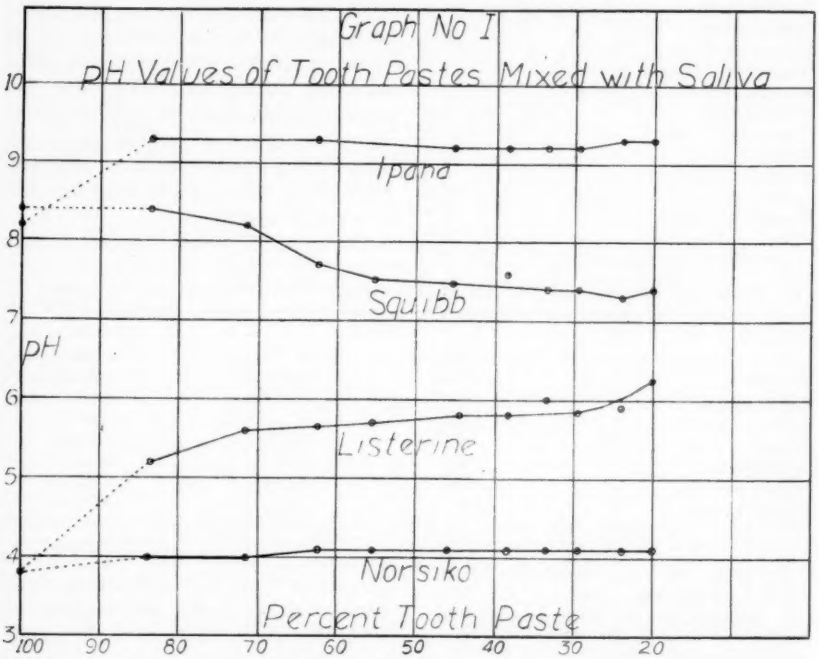


Fig. 3.—p_H of various tooth pastes mixed with saliva in a ratio of 1:4.

to some common substances. A buffered solution is simply one which resists change in p_H. Saliva is endowed with this property, and in order for a tooth paste saliva mixture to have p_H values markedly different from that of the saliva itself, this buffering power must have been broken.)

EXPERIMENTAL DATA

In all cases, the products studied were obtained on the open market. All p_H determinations were made by means of the glass electrode. In Table I are recorded the results obtained on the dentifrices themselves and on mixtures of dentifrices with saliva and with water. In all cases wherein mixtures were studied, a stirrer driven with an electric motor was used to obtain uniform mixing.

In Table 2 are shown the results obtained by progressive addition of fresh saliva to weighed samples of dentifrice, a process which simulates that produced in brushing the teeth. In these experiments, care was taken to check the time interval between each addition of saliva and the subsequent p_H determination. For convenience in tabulation, the p_H values are given for corresponding percentage values of tooth paste.

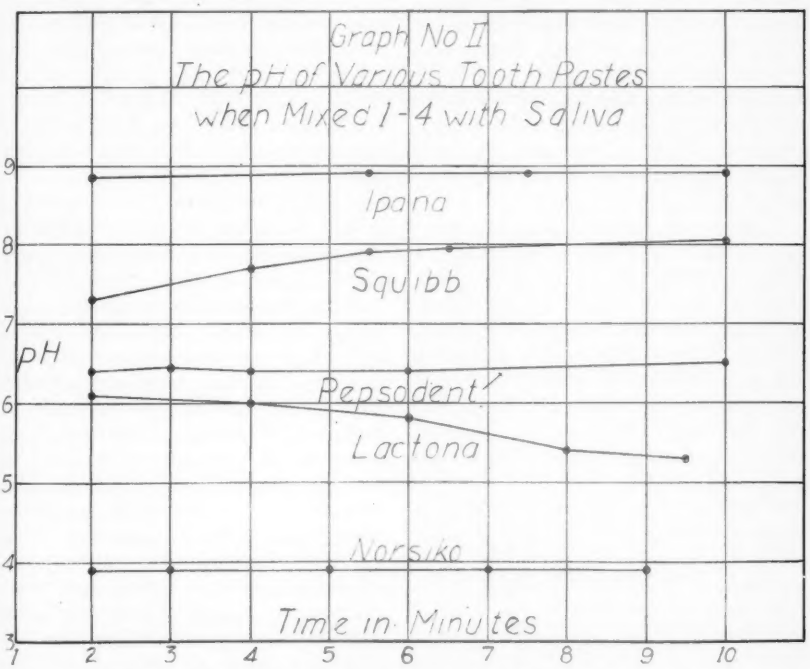


Fig. 3.—p_H of various tooth pastes mixed with saliva in a ratio of 1:4.

The results given in Table 3 represent the mean values obtained from several experiments in which the teeth were brushed for one minute with each of the specified dentifrices. Immediately after

each brushing, p_H measurements were made on the expectorated mixture of dentifrice and saliva.

In order to follow as closely as possible the changes in p_H occurring during brushing of the teeth, the following experiment was tried on several dentifrices: Brushing was performed as before except that, at intervals of fifteen seconds, forty-five seconds and sixty seconds, small amounts of mixtures of tooth paste and saliva were gathered for p_H measurements. In all of these experiments, ten trials were made for each tooth paste. Approximately the same amount of dentifrice was in each case applied to a brush slightly wet with water. The results, shown in Table 4, represent the mean values obtained from ten separate experiments on each dentifrice.

A glance at Figure 2, which is based on the data in Table 2, indicates the widely differing values obtainable by such a study. In this graph, the percentage of tooth paste has been plotted against the p_H. The reading at 100 per cent is the p_H of the tooth paste alone. The other points on the curve represent the p_H values of successive dilutions until a mixture of 20 per cent tooth paste with saliva has been reached.

It was noted, in the course of this investigation, that the time factor is sometimes important in the determination of p_H values obtained for mixtures of saliva and dentifrice and for mixtures of water and dentifrice. In all of the alkaline tooth pastes studied, with the exception of Squibb's, the p_H values obtained for a one to four mixture of dentifrice and saliva were nearly constant with time. In the case of Squibb's dentifrice, there was a gradual rise in p_H with time, indicating slow solubility of the active ingredient. In the case of the acid preparations, Norsiko was the only one which broke the buffering power of the saliva completely, so that there was no apparent change of p_H with time. With the other three acid preparations, Pepsodent, Lactona and Listerine, some differences were apparent. In the case of Listerine, there was but slight change of p_H with time. In the case of Lactona, there was a gradual decrease in p_H with time, indicating the presence of reserve acidity. In the case of Pepsodent, the reserve acidity was apparently not so great, for a slight rise in p_H occurred with time. Typical results obtained are shown in Figure 3, in which the p_H is plotted against time.

COMMENT

The data which have been presented here are intended to help clarify only one phase of the dentifrice problem. It is hoped that the results are of sufficient value to be used in conjunction with other data for the purpose of studying the entire group of tooth cleaning preparations.

Although the results presented here are subject to certain errors, the method utilized for the measurement of p_H is quite reliable. This is not true of other methods as applied to the mixtures studied in this report. Probably the largest source of variation to be found in these experiments involves the measurement of the p_H of the dentifrices themselves. This is due in large part to the fact that variation in age and in water content of the tooth pastes produces a variation in p_H value. Those experiments which involve a solution of the dentifrice either in saliva or in water are probably not influenced to an appreciable extent by these factors. The values thus obtained form, therefore, a more useful criterion of the acidic or basic tendencies of the products.

A study of the data presented here shows clearly that no one set of observations on the dentifrices used is sufficient to give a clear picture of the behavior of

the preparation when employed in the mouth. It is necessary to take into account the results obtained in several experiments. Such a combination of data should be sufficient to give a fair approximation of the series of p_H values produced when the teeth are brushed with any given dentifrice. The experiments in which the teeth were brushed, for example, do not show the extremes in p_H obtainable, but indicate the mean values to be found in the mixture of dentifrice and saliva. To obtain a nearer approximation to the exact picture, one must take into account such items as the following: The p_H of the dentifrice itself, the p_H on dilution with saliva, the p_H obtained in the brushing experiments and the reserve acidity or alkalinity of the product. The time employed in brushing, as well as the technic of brushing, is also to be considered.

CHILDREN'S DENTISTRY IN RELATION TO PREVENTION OF DENTAL ANOMALIES*

By GEORGE E. MORGAN, D.D.S., F.A.C.D., Milwaukee, Wis.

MANY papers have been written on the treatment of dental anomalies, but, in our busy practices, in trying to correct the deviations from normal, we have lost sight of the most essential and important—their prevention. Children's dentistry, or pedodontia, as most of us prefer to term it, plays a rôle in the prevention of most dental anomalies. Many of the anomaly problems can be solved through the proper application of prevention.

While a dental anomaly may be any deviation from the normal, either congenital or acquired, I shall discuss only those conditions which can be prevented by better dental care of children. Just as the question of the pulpless tooth is being solved by preventing the pulp from becoming exposed, so can the number of dental anomalies be reduced by preventing the conditions which cause them.

*Read before the Section on Orthodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

THE CONDITION OF SCHOOL CHILDREN

In examining the children of our public schools, it was revealed that the 4 and 5 year old children in kindergarten had less decay than those in the third and fourth grades. A large number of them reported that they had had dental care, but there was nothing to indicate that the care had been of a constructive nature. Many mouths showed that teeth had been extracted. Fragments of roots were clinging to inflamed gums and there was pus exuding from the apices of roots, and cavities both small and large. I suspect that the condition in this community was no different from that in average schools in other parts of the country.

A PUBLIC DUTY

Dentists must be awakened to the fact that the public is going to demand more adequate dental service for children. I have seen dentists spend hours and hours in the construction of bridgework and in other restorative work for adults to make

certain that all details were perfected to the finest degree of accuracy, and yet these same men would completely ignore the essential factors in the care of their child patients.

Perhaps we have spent too much time in educating the public to the value of early dental attention during childhood and not enough time in teaching the dentist how to render adequate service. Many reasons have been advanced by members of our profession for the general dislike of children's dentistry, the most outstanding of these being the claim that the lack of remuneration accounts for the slipshod methods used. The truth of the matter is that the parents of today are more willing to pay for the care of their children than for their own care. Their difficulty is to find a dentist who can render good dental service to children.

In the examination of school children, it was clearly demonstrated that most of the dental work that had been done was so poor that the child would have perhaps been better off without it. As Phillips Brooks says, "The future of the race marches forward on the feet of little children," and thus we as dentists owe our greatest duty to better dentistry for children.

PERIODIC CARE

One of the greatest enemies of the practice of prevention in dentistry for children is high pressure radio advertising by toothpaste companies, "Take your child to the dentist every six months." Even the dental profession has failed to do their part in educating the public to the value of periodic care. The fact that we recognize the prevalence of dental caries during childhood and that it is easier to prevent than to correct should impress us not only with the importance, but also with the necessity of periodic care.

When I speak of periodic care, I mean that the child's teeth should be cleaned and examined as frequently as is necessary to keep the mouth healthy and free from decay. Children with great susceptibility to decay should have prophylactic care and an examination more frequently than those with a greater degree of immunity. The dental hygienist is indispensable in rendering prophylactic dental service to children. Angelo Patri says, "Sound teeth come before sound digestion and sound digestion is the root of all wisdom."

The economy involved in such dental service for children is very evident when the value of periodic care has been proved over a period of years. Children cannot be seen at too early an age nor too frequently if we have the health and function of the mouth in mind. At the early age of 3, growth and development cause spaces between the teeth where food can easily collect. These places in the molar region are most susceptible to decay if precautions are not exercised to prevent the accumulation of food débris. With the exfoliation of the deciduous teeth and the eruption of the permanent successors, we have impaired function and a condition inimical to oral hygiene.

Periodic care cannot be overindulged in in childhood if we are to be responsible for guiding the teeth to normal health and function.

ROENTGENOGRAPHIC EVIDENCE

How successful would our dental services to the child be without the use of the roentgen rays? And yet do we make the most of this opportunity at hand? I have known dentists who treat every deciduous tooth with no knowledge of what is taking place in the jaws of the child. Parents have a right to demand certainty as to the condition of the child's mouth. Are we able to enlighten them?

Here again, by the frequent use of the roentgen rays, we check the progress of dental caries, obviate the need of premature extraction, avoid prolonged retention, expose root fragments and supernumerary teeth and reveal the congenital absence of teeth. Each case is a law unto itself and the treatment of it must be specialized.

The use of the roentgen rays helps to prevent pain, disease, premature loss and malocclusion. It is just as important in the periodic care of the child as is prophylactic care, because an examination without roentgenographic knowledge of the case is made blindfolded as far as the existing conditions in the mouth are concerned.

PREMATURE LOSS

The most frequent cause of premature loss of the deciduous teeth is dental caries which is beyond repair. While we do not know how to prevent decay, we do know, or at least should know, how to check its progress. Brandhorst[1] has shown, in a survey of 100 cases of dental anomalies, that 56 per cent were the result of premature loss and prolonged retention of the deciduous teeth. Probably, next to dental caries, we can attribute the premature loss to improper restoration resulting in recurrence of decay; in other words, poor dental work. By improper restoration, I mean both cavity preparation and the filling materials that are used to restore the deciduous tooth to health and function.

There seems to have been a misunderstanding in the past as to correct cavity preparation and the best filling materials to be used for children. Why do we allow ourselves to be misguided by that incorrectly applied term "temporary" in our operative procedures and in selecting filling materials in dentistry for children? Dentists who continue practice with that thought are risking the title "unprogressive."

The fact that many dentists prematurely extract a deciduous tooth to make room for a predecessor when the jaws of the child show lack of growth and development leads me to believe that a better understanding of what takes place in the jaws during childhood is the only preventive measure for these wholesale extractions. Nature in such cases does activate to premature resorption and we may think that the end-results are the same, but, in premature extraction, nature plays no part; while, in premature resorption, she may stimulate growth.

Then, too, we have premature resorption due to overactivity of the osteoclasts or resorptive organ, which brings about premature loss. These cases are usually in the minority and should cause us little concern.

Probably the most harm resulting from premature loss of the deciduous teeth results from traumatic injury. It may be the loss of only one tooth from a slight bump or the loss of several teeth from a more serious accident. Traumatic injury of the mouth, when not properly treated, brings about a mutilation which it requires much skill and knowledge to correct. The pedodontic section of the Detroit Study Club[2] has made an interesting study of fractured anterior teeth of children and have published the results of their findings.

PROLONGED RETENTION

I believe that the primary cause of prolonged retention is abnormal resorp-

1. Brandhorst, O. W.: Promoting Normal Development by Maintaining Function of Deciduous Teeth, J.A.D.A., 19:1196-1203 (July) 1932.

2. McBride, W. C.: Fractured and Lost Anterior Teeth, Internat. J. Orthodontia, 19: 735-752 (July), 849-864 (Aug.) 1933.

tion of the roots of the deciduous teeth. I shall not discuss deciduous root resorption, but refer you to the work done by Kronfeld.[3]

POORLY CONSTRUCTED APPLIANCES

Too much care cannot be exercised in the construction of appliances for the treatment of malocclusion. The presence of ill-fitting and poorly constructed appliances is often the cause of additional caries and pathologic conditions of the soft tissues of the mouth during orthodontic treatment. It is the duty of every dentist performing dental service for the child to do his utmost, and if this is done, it is usually none too good. Ligatures lacerate gums, provide harboring places for bacteria and impair oral hygienic measures.

Ill-fitting and poorly constructed appliances hinder mastication and make orthodontic treatment painful. The child becomes irritable, and a general dislike for dental care is aroused. The results in such cases are unsatisfactory and a poor practice builder.

RESPONSIBILITY

Who is responsible for the oral health of the child referred by the general practitioner to the orthodontist for treatment? The parent usually feels that the orthodontist is responsible for the detection of caries, and I believe that the parent is right in placing this responsibility on the orthodontist. The orthodontist must assume this responsibility if he has the child's interests at heart.

The relationship between the pedodontist and the orthodontist is becoming closer year by year. Some orthodontists are now seeing the value of either doing the operative phase of the work themselves or having some one in the office who can do it. The pedodontist likewise is practicing orthodontia or having someone in the office do it. These two phases of children's dentistry are of paramount importance to the child's welfare and the responsibility must be assumed by the one dentist or by two men in the same office.

2039 North Prospect Avenue.

3. Kronfeld, Rudolf: Resorption of Roots of Deciduous Teeth, D. Cosmos, 74:103-120 (Feb.) 1932.

FACTORS IN THE ETIOLOGY OF MALOCCLUSION*

By WALTER HYDE, D.D.S., Minneapolis, Minn.

A PAPER on the etiology of malocclusion by one who is a mere clinician and only a reader, not a statistician or researcher, is almost certain to be more or less of a disappointment. Those causes that are at all certain and constant in their effects are so simple and obvious that they are of but little interest, while the forces operating in the fields of nutrition, constitution and inheritance are so obscure or complex and remote, in most cases, that the average practitioner soon becomes discouraged or completely lost in attempting to understand them. It is not surprising that numerous good men have directed much

*Read before the Section on Orthodontia at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

effort toward perfecting their mechanical technic and have passed somewhat lightly over the more profound aspects of etiology.

The orthodontist's point of view through the years has been changing steadily, from the almost entirely mechanical to one that is more scientific and biologic. All sorts of things, since the earliest medical writings, have been assumed to be the causes of malocclusions. These statements have usually expressed snap judgments or were based upon some "authority," and they have been of but little real value. This is possibly the reason for such conclusions as Hellman's when he says, "When put to the test not one of the recommended factors bear any definite relationship to a particular form of malocclusion," or Brash's, when he reaches a negative conclusion as he considers in turn each of the things that have been commonly held to be the cause of malocclusion.

Attention to etiology has varied greatly in different periods. It is of considerable interest to note that Angle, in his text, devoted but one chapter to etiology and considered it then only after he had discussed several other topics. It is of further interest to note that, as early as 1879, Kingsley devoted the first two chapters of his book to this topic. In these later days, Wallace and Brash write entire books on the subject.

As the point of view changes, so does the terminology. Years ago, it was not unusual to speak of the "causes" of malocclusion; but etiology has proved to be so complex a matter, in relation to any abnormal condition, that writers now speak of "factors" as was done in the assignment of the title to this paper. Any cause is likely to be composed of a number of factors. It is regrettable that the advances in our knowledge have not enabled us to be more certain. As many of the findings and conclusions of our investigators are negative, one would, I presume, have great difficulty today in getting an experienced orthodontist to say, without qualifications, that he thought adenoids and tonsils and mouth breathing have anything to do with crooked teeth.

This attitude is well shown by the remark of a friend of mine recently: "Twenty years ago, I was so sure of many things that I could have easily written 3,000 words on etiology, but today I would be at a loss in attempting to make a single definite statement concerning any single factor."

We can only hope that such confusion and uncertainty is a healthy sign and that, in due time, we may emerge from this state and stand upon firmer ground, where we can be at least somewhat more certain of the problems with which we have to deal.

There have been many classifications of etiology. Probably that of N. N. Bery[1] is the most complete and exhaustive. He divides his classification in three major divisions: (1) general, (2) proximal and (3) local. George R. Moore suggests that two divisions: (1) remote and (2) proximate,[2] are simpler and quite adequate, with which suggestion I agree.

Bery's classification and discussion should be a great comfort to the student who has been distressed by the previously mentioned uncertainty. Bery accepts practically every condition that has at any time been put forward as a cause for malocclusion, even to the classical "large teeth of the father and small jaws of the mother,"[3] listing and describing them at length.

1. Bery, N. N.: Internat. J. Orthodontia, 18:22 (Jan.) 1932.

2. Moore, G. R.: Internat. J. Orthodontia, 19:11 (Jan.) 1933.

3. Footnote 1, p. 24.

Under general causes he lists six divisions: 1. Dystrophic heredity, which includes all familial traits, Hapsburg jaw, etc., also including such manifestations as:

(*a*) Achondroplasia, i.e., shortening of the condyles and basilar portions of occipital bone and the backward tendency of the nasal portion of face.

(*b*) Cleidocranial dysostosis; i.e., the forward displacement of the upper part of the face.

(*c*) Craniofacial dysostosis; i.e., early synostosis of skull bones and reduction of facial bones.

(*d*) Other extreme and unusual abnormalities.

2. Pathologic heredity, under which he lists the hereditary effects of syphilis, tuberculosis and ethylism. He suggests that the presence of supernumerary teeth, Hutchinson's teeth, erosion and cleft palate is due to syphilis, as is the fact that teeth are congenitally absent.

3. Congenital factors: malformation due to intrauterine disturbances, either early or late, most of them originating in the first six weeks but carrying over from the embryonic stage to the fetal; adverse amnionic pressure or abnormal presentations for delivery. Faulty cell metabolism or actually defective germ cells or those without normal resistance would fall into this division.

4. Endocrine disturbances. Under this heading, Bery states that systematic investigation and experimentation have proved that the endocrine secretions have a very definite influence on the development and preservation of the teeth and jaws. He cites numerous authorities.[8] He makes the point that teeth and bone depend on normal tissue for shape and position and integrity. Therefore, any altered metabolism due to changes in endocrine function, during the developmental period, will interfere materially with the growth of the teeth and jaws. To such disturbances, he charges abnormal shapes of the jaws, abnormal bites, various degrees of malocclusion and predisposition to caries; also, irregular growth of the teeth, as indicated by retarded eruption, complete retention, aberrations, tortion, germination hypertrophy, hypotrophy in mass, complete absence of single teeth or whole groups of them, supernumerary teeth and displacement of tooth germs. He then considers the endocrine glands separately. I shall not consider all of the subject, although I fully recognize the importance of this somewhat obscure field.

5. Malnutrition and malcalcification. Bery cites the work and opinions of Keith, Howe, Mellanby and Lennox to show that lack of adequate minerals and vitamines is a cause of malocclusion. All of this subject has been covered in detail many times.

Proximal causes are discussed under seven divisions:

1. Habits, which are divided into sucking, biting and posture habits. A habit is a "constant practice established by frequent repetition." Habits are normal manifestations of living tissue. Normal habits are associated with normal function. A pernicious habit is an expression of a normal manifestation gone wrong. Such habits as sucking and biting are innate in a human being and are necessary to his life and well-being. It is only when their indulgence is excessive and abnormal that it is fraught with disastrous consequences.

Postural and pillowing habits must surely be associated with a poor quality of bone and other abnormalities, if they become factors in malocclusion.

2. Mouth breathing and nasal lesions. These are listed second in Bery's classification and are stated without qualification to be a cause of malocclusion. The

familiar mechanism is described and mention made of the various associated conditions. Until the appearance of a paper by Howard on "Inherent Growth and Its Influence on Malocclusion," it was probably not much questioned that at least many cases of malocclusion were associated with the mouth breathing habit. His statement that of 159 mouth breathers examined, ninety-four exhibited normal jaws, normal arches and normal occlusion was rather startling to some of us. I am certain that no such percentage of the mouth-breathing children I have known have a normal occlusion. Full recognition is given to the fact that the average orthodontist sees, almost exclusively, dental abnormalities. The mouth breathers with normal occlusion do not come to the orthodontist's office. This may give the careful observer an exaggerated idea of some of the causes of malocclusion. Such ideas can, of course, best be corrected by the study of accurate statistical material. Regardless of whether clinical experience is in agreement with statistical findings, the wise orthodontist will not give up the attempt to establish normal respiration as a part of his routine treatment.

3. Abnormal frenum labii. This is another commonly listed cause. In my opinion, actual abnormality is rare.

4. Lack of muscular balance.

5. Temporomandibular articulation; displacements and effects of cicatrical contraction, etc.

6. Bony lesions, including harelip and cleft palate and effects of trauma.

7. Abnormal tongue.

LOCAL CAUSES

Under local causes, Bery offers two divisions, dental and maxillary.

1. Dental causes.

(*a*) Early loss of deciduous teeth.

(*b*) Tardy loss of deciduous teeth.

(*c*) Tardy eruption of permanent teeth.

(*d*) Early loss of permanent teeth.

(*e*) Oversized teeth in undersized jaw or vice versa.

(*f*) Anomalies in number, either too few or too many.

(*g*) Caries.

2. Maxillary causes.

(*a*) Size of apical base.

(*b*) Atrophy from lack of use, which may become hereditary as to the entire masticatory apparatus.

(*c*) Maxillary malformation in any dimension.

In the number of varying items included and the wide territory covered, this classification leaves but little to be desired. The objection remains that much of the matter included has never been actually proved from a scientific point of view and also that these various factors, even the simplest of them, are so far from certain in their effects that one can never say: such and such is an invariable cause of malocclusion.

Nothing could be much simpler and easier of comprehension than malocclusion caused by the presence of a supernumerary tooth; or by the unfortunate loss of a deciduous tooth; but it must be admitted that neither one of these things always results in a malocclusion.

It has long seemed to me that lack of function, not only function but also vigorous function, has frequently failed to receive the attention it merits. Willett states[4] that over half the cases which he sees are complicated by premature loss of deciduous teeth and consequent loss of function. In my own practice, the complication by loss of deciduous teeth is a very much smaller percentage, probably not more than from 1 to 2 per cent, but the fact remains that a great many of the

4. Willett, R. C.: Personal communication to author.

children could by no stretch of the imagination ever be said to have vigorous function in masticating.

It is too much to expect that the inherent capacity for growth in the maxillary structure is great enough to develop an ideal occlusion without the stimulation of vigorous function; although even this opinion is somewhat nullified by the occasional observation of well-developed jaws when many adverse conditions seem to surround the individual.

As is usually the case in dealing with this subject, a survey of the available material leaves us in a frame of mind that is most unsatisfactory. There seems then nothing for us to do but heed Brash's suggestion that the time has arrived to substitute for the provisional hypothesis of environmental influence in the wide sense, which appears to have inspired most of the investigations and most of the discussions in the past, the other provisional hypothesis that irregularity and most malocclusions are inherited conditions, and let that inspire future discussions and future investigations.[5]

Fig. 1.—Arrangement of genes in genetic system. One string (*P*) comes from the father, the other (*M*) from the mother. Thus, the genes themselves are in pairs, one member of each pair from the father, one from the mother. The genes showing no mottling in the drawing are to be conceived as defective. (After Jennings.)

What, then, does the available knowledge of heredity offer the inquiring orthodontist? An answer to this question will depend on what we can find in the recorded studies in the branch of biology called genetics. The science of genetics is really younger than the specialty of orthodontia. The real accumulation of evidence has been made within the last twenty-five or thirty years. Among the higher organisms, including man, the individual begins its existence by the union of two particles derived from two other individuals, the parents. This microscopic cell is the fertilized egg and the completed individual matures by repeated divisions of this single cell, which consists of a nucleus surrounded by a nutrient material called cytoplasm. The nucleus consists of a group of distinct particles, the chromosomes.

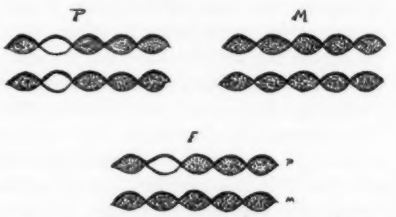


Fig. 2.—Illustration of case in which father (*P*), having two genes in second pair defective, is himself defective. The mother (*M*) is normal. The child (*F*) receives one set of genes from each parent. It therefore has at least one normal gene in each pair and is not defective.

To quote from Jennings:

> Positive and unescapable experimental evidence proves that the chromosome is a structure composed of many diverse parts,

5. Brash: Dental Board Lectures, 1929.

each part or gene having a definite effect on development, and therefore a definite effect on the characteristics of the individual produced. The rules of inheritance of characteristics result from the way these chromosomal parts are distributed in passing through the germ cells from parent to offspring. To understand inheritance and development, it is essential to understand the behavior and distribution of the chromosomal parts.[6]

To understand heredity and its results, we must have in mind a picture of the genetic system and its operation. Any one who declines the labor of becoming familiar with the fundamental features of the genetic system cuts himself off from the possibilities of understanding the nature of man. It is the intention to indicate superficially the mechanism that has been concluded to exist from the observations and experiments of the workers in the field of genetics.

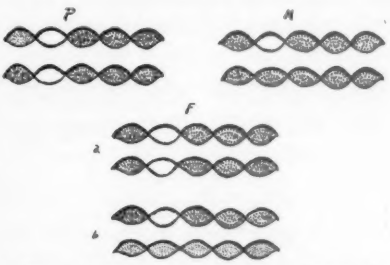


Fig. 3.—Illustration of case in which one parent (*P*) has two defective genes in one pair, the other (*M*) having one defective gene in same pair. Some of the children receive two defective genes in one pair and are therefore defective. Others with but one defective gene in that pair will not be defective.

In the human being, there are forty-eight chromosomes each consisting of hundreds of particles, like beads on a string, and always in pairs, like two strings of beads. In some of the simpler organisms and plants, this arrangement is actually visible under the microscope.[7] Graphically, they might be illustrated in this manner. (Fig. 1.) Each small part is called a gene. Those unshaded indicate a gene that carries an inheritable defect, and in results that may come from the defective gene will be found our interest in the subject as orthodontists.

Each of the thousands of these genes is a distinct substance that has a definite part in the production of the new individual. If any one of them, or groups of them, is destroyed or changed, the resulting individual will show a corresponding change in some of his characteristics, as, for example, the color of his eyes or his stature. It is known that each different gene or group of genes has its regular place in the string and will always be found in this position. This has been experimentally worked out with such care and detail that the gene arrangement of

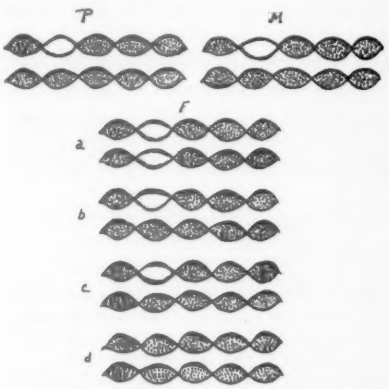


Fig. 4.—Illustration of case in which parents having one defective gene each in the same pair are normal, but may have children with four combinations: *a*, defective; *b*, *c*, normal but carrying the defective genes, or *d*, normal.

6. Jennings, H. S.: Biological Basis of Human Nature, New York City: W. W. Norton and Company, 1930.

7. Footnote 6, p. 5.

the fruit fly, Drosophila, has been mapped.[8]

Each parent contributes to the new individual a complete set of genes; which accounts for the double arrangement that has been likened to two strings of beads, one full string from the mother and one from the father. This arrangement is the key to many of the puzzles in the makeup and character of humanity. It explains many of the peculiarities of inheritance.

The different pairs of genes have different functions in development, but the two members of each pair have the same function, though they may operate in a somewhat diverse manner; e.g., one from the father may tend to produce brown eyes, while the one from the mother may

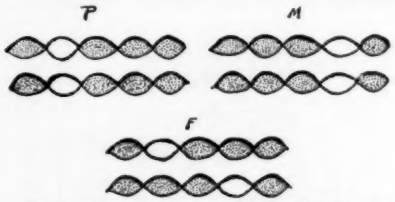


Fig. 5.—Illustration of case in which father (*P*), having both genes defective in the second pair, and mother (*M*) having both genes defective in the fourth pair, are defective. The offspring has no pair in which both genes are defective and is therefore normal.

tend to produce blue eyes. In this case, the new individual will have brown eyes because the father's gene tends to carry development farther, i.e., lay down more pigment. The brown-eyed characteristic is called dominant, the blue-eyed characteristic recessive. Or one gene in the pair may be defective, but if the other gene is normal, the offspring will be normal because the normal gene tends to be dominant. (Fig. 2.)

If, however, both genes of one parent are defective, and one gene of the same pair in the other parent is defective, some of the offsprings will be defective and some normal. (Fig. 3.)

A defect of this kind might take almost any form, such as color blindness, feeble mindedness or less serious mental or temperamental characteristics.

Two normal parents might have defective children, in the manner shown in Figure 4.

Inferior or defective parents can produce superior or normal children as shown in Figure 5.

Defective parents can produce defective children, as shown in Figure 6.

This very superficial view gives us some idea of the mechanics of this process. All of these observations and a multitude more are well founded on experi-

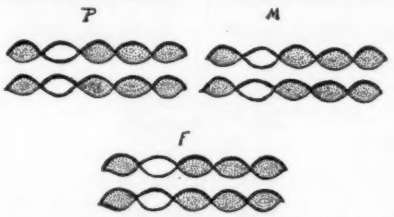


Fig. 6.—Illustration of case in which both parents have both genes in the same pair defective, the offspring then being defective.

mental work by many research workers. It is an intensely interesting matter and one that will repay study.

The next question that occurs is: What kind of characteristics depend on the genes? The answer to this is that all types of characteristics, all manifestations of life can be altered by altering the genes. Structural characteristics, both internal and external, colors, sizes, shapes, chemical properties, physiologic functions, senses and behavior, all have been shown to be changed by changing the genes. This is really not a matter for surprise. It is simply saying that chang-

8. Morgan, Bridges and Sturtevant: Bibliographica Genetica, Vol. 2.

ing the material from which an individual is made changes the individual.

Our final question, then, is: Are the teeth and jaws to be included in the structures that can be affected in this manner? In reviewing this subject, I have been able to find only the most casual reference to teeth, but when all other physical structures can be affected, it would seem most unreasonable to exclude the teeth and jaws. It would seem perfectly logical to assume that a malocclusion that could not be explained as a matter of environment must be the result of certain defective genes or groups of genes and therefore a matter of inheritance.

To approach this subject properly, it will be necessary for most of us to free our minds of certain old ideas of inheritance. For many, if not most people, heredity means the passing on of similar characteristics from parent to offspring. But actually it means more than this. Differences are just as readily inherited as similarities. While it is true that families, being made up largely of the same gene material, will show many likenesses, what any individual is depends on the combination of genes that enter into his make-up. Thus it becomes apparent that a child with a malocclusion (assuming that it is subject to inheritance) does not have the condition because his mother did, but because, in the union of genes that produced him, there were sufficient defective genes in combination to affect his development.

Another error that we must avoid is thinking that the characteristics of any individual can be divided into two distinct classes, one the result of heredity, the other of environment. We must here go back to our earlier statement regarding dividing the thought of "cause" into "factors." All characteristics are the products of development, and development is an action between the inherited material and other things, one of which is environment. While it is true that changing genes can change characteristics, it is also true that changing environment can produce changes. In this way, we may say that most characteristics are both hereditary and environmental. Both the genes and the environment have a part in producing them and they may be altered by changing either.

There are other errors into which we are apt to fall, but mention will be made of but one: we should avoid forming any judgment on the subject of heredity, except on the basis of carefully conducted experiments. There is already a great amount of material of this kind, and undoubtedly future experiments will provide material nearer our own field of specialization.

The end of an attempt at a résumé of etiologic factors does not find us perceptibly nearer a solution to our unsolved problems, but it may point a way. We can surely hope that our leaders in biology will ultimately give us something that will make us more certain in matters of etiology; for uncertainty as to etiology will always mean uncertainty as to treatment.

PRACTICAL BIO-ENGINEERING IN FULL DENTURE CONSTRUCTION*

By ARTHUR P. LITTLE, D.D.S., Richmond, Va.

IT is gratifying to note the change that is gradually coming over the dental profession regarding full denture construction. In the not too distant past, this branch of restorative dentistry was considered by the average practitioner as purely a mechanical procedure. The matter of building a set of full dentures was looked on as a static problem, and the methods of procedure in the treatment of edentulous patients were designed to have universal application.

Perhaps many of our failures can be traced to the fact that too much attention has been directed toward the subject of full denture construction from the standpoint of technic alone; i.e., methods of making dentures.

A good accurate technic is essential to success, but the method of procedure must always be subordinated to, and developed in harmony with, the biologic laws of the dental system.

Two distinct major problems confront the operator when he attempts full denture construction.

The first problem is that of designing and building dentures that will satisfactorily serve as an aid in restoring function to the dental system. The other problem consists in constructing a type of denture that will continue to serve efficiently as the mouth conditions change after the dentures are inserted. These problems are inseparable.

Every dentist is familiar with the destruction that takes place in the supporting structures after the use of poorly designed and poorly constructed full dentures. Granting that there is still much to be learned about the bone cells that make up the supporting ridges in different patients and regarding the way these bone cells react after full dentures are placed upon them, it is, nevertheless, common knowledge that much less destruction of supporting tissue takes place after the use of full dentures that have been made in accord with the engineering and biologic factors involved.

Certain natural forces that are of direct importance to the prosthodontist originate in the dental system. The fact that these forces arise from living tissue gives to this work a biologic aspect.

The studying, planning, surveying and utilization of these natural forces in relation to the vital structures that support the dentures, and to the surrounding tissues of the mouth, make up what is termed "bio-engineering."

In presenting the subject of practical bio-engineering in full denture construction, an attempt will be made to show how numerous engineering principles are utilized and employed in building a set of full dentures.

Knowledge is necessary as to how these various natural forces operate, and also how they are influenced as a result of the

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

changes that take place in the mouths of patients after the insertion of dentures, if they are to be properly controlled during the life of the denture.

The importance of bio-engineering in full denture construction can best be appreciated after a study of the relation that mandibular movements and stress distribution bear to the resilient and changing tissues that support the dentures during function. In the edentulous case, the associated masticatory muscles remain practically the same as when the teeth were present.

This muscular mechanism, which also produces mandibular motion, was developed from birth, and is maintained throughout life, by function.

Fig. 1.—Curve revealed by analysis of occlusal surfaces of teeth.

Originally, in each individual, there was present a full complement of teeth securely embedded in the alveolar process. In analyzing the occlusal surface of all these teeth combined, it will be found that the teeth in the maxillae, as well as the teeth in the mandible, present a series of curves. (Fig. 1.)

In the maxillae, these curves present a convexed arrangement; while in Figure 2, the mandibular curves are concentric, which gives the combined occlusal surfaces of the mandibular teeth a concave or saucer-shaped arrangement. As George S. Monson pointed out, and as shown in Figure 3, the long axes of these teeth are radially grouped toward one common center, the center of applied force.

The mandible is suspended from the cranium by various muscles and ligaments (Fig. 4), very much as a swing might be suspended from the limb of a tree. When the mandible is placed in motion by muscular contraction, its path of travel, either protrusively or laterally, must of necessity describe a series of arcs.

We see that nature exhibits in her architectural arrangement of the teeth a definite mechanical relationship to the character of the mandibular movement produced. In other words, the motion is relative to the form, and the form is relative to the motion.

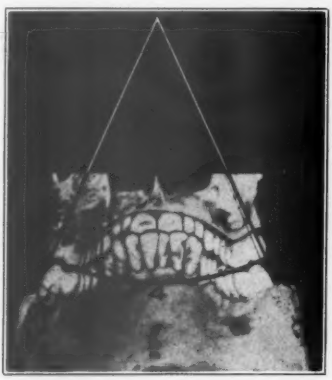


Fig. 2.—Concentric mandibular curve.

Figure 5 shows additional evidence of a definite relationship between the structural form of all the teeth combined and the mandibular movement, which may be seen by examining the teeth and the muscles of mastication together. It will be noticed that if the curve of Spee is projected back toward the condyle, this curve will cross the masseter muscle at

right angles to the long fibers of the muscle.

The arc *A-C-B* represents a continuation of the arc of the occlusal surfaces of the teeth. The resultant pull (*P*) of the masseter muscle is at right angles to the curve of Spee. Hence, when the entire muscle is functioning, the resultant pull becomes a radius to this curve, as are the teeth themselves.

By way of comparison: When a horizontal or flat plane is used for an occlusal surface, the power of this muscle is greatly restrained, and an unbalanced muscular condition is produced.

A like examination of the internal pterygoid muscles (Fig. 6) shows the same definite relationship between the

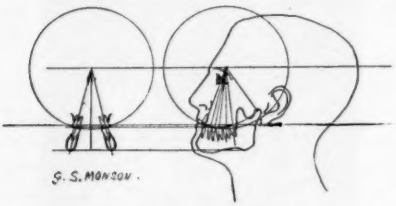


Fig. 3.—Diagram showing that long axes of lower teeth are radially grouped toward one common center of applied force.

structural arrangement of all the combined teeth and the motion, as represented by these muscles.

In concluding this brief analysis of the fundamental factors that pertain to the architectural form and to the motion of the masticatory apparatus, some consideration should be given to the character and direction of mandibular motion on the horizontal plane. In Figure 7, the triangle with the heavy lines represents the mandible in centric occlusion. The angles at the base of the triangle are in the positions occupied by the condyles in the glenoid fossae, while the apex of the triangle occupies the position of the lower central incisors in centric occlusion.

The triangle drawn in with dotted lines represents a position of the mandible when moved laterally from the centric position. It will be seen that the apex of this triangle has moved forward as well as laterally in the course of its travel.

An understanding of the exact direction of mandibular movement on the horizontal plane, i.e., forward and laterally from the centric position, is of great importance to the prosthodontist. It will be shown later that a lack of knowledge, or disregard of the character of lateral mandibular movements in constructing

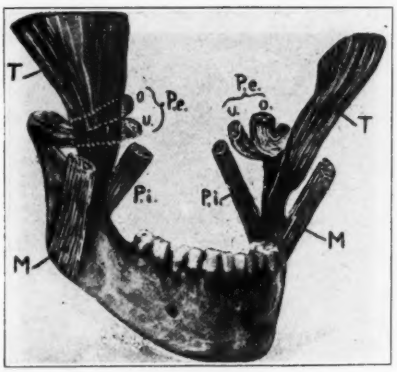


Fig. 4.—Various muscles and ligaments suspending mandible from cranium.

dentures will result in a failure to distribute properly the applied stress of mastication.

This analysis of the motion and form of the normal dental system has been made to show that there exists a relationship between the masticating muscular mechanism, the design of the supporting osseous structures, the architectural arrangement of the natural teeth and the character and values of the mandibular movements.

With this fundamental knowledge in mind, in planning replacements for the

natural teeth, artificial restorations may be designed and constructed that become a coordinating unit with the remaining anatomic parts.

Originally, a full complement of natural teeth served as a means of maintaining occlusal contact between the maxillae and the mandible. Each tooth securely supported by alveolar process was capable of receiving and absorbing its share of the applied stress of mastication. By virtue of this alveolar anchorage, the natural teeth were a determining factor in the direction of the mandibular movements and also served to maintain a more or less constant vertical dimension or

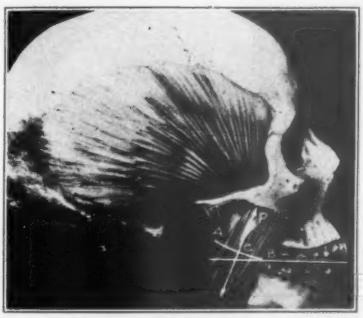


Fig. 5.—Additional evidence of definite relationship between structural form of all teeth combined and mandibular movement.

interdental space between the mandible and maxillae.

As shown in Figure 8, after the teeth are lost, the only contact that remains between the cranium and the mandible is made through the medium of the condyles. The muscular mechanism of the dental system, although reduced in efficiency, can be utilized to produce sufficient motive power for mastication.

The interdental space formerly maintained by the natural teeth is continually shifting because of the fact that there exists no fixed position in which the mandible can come to rest.

As a substitute for the original individually supported natural teeth, there will be constructed two bases, resting on the ridges, each supporting fourteen teeth. As each base, or denture, is a solid unit, anything that affects one tooth will influence the whole denture. In reality, each denture becomes a single unit. Where formerly thirty-two individual units were present and made up the natural denture, there are now employed but two. The proper distribution of the ap-

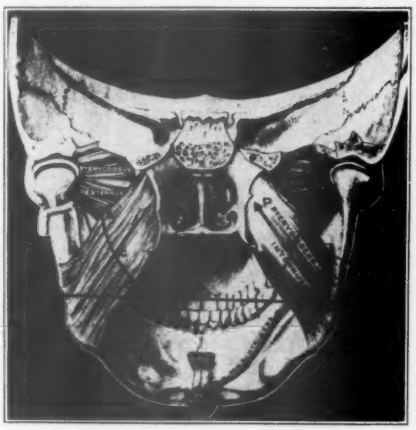


Fig. 6.—Definite relationship between structural arrangement of all combined teeth and motion as represented by internal pterygoid muscles.

plied stress of mastication over these two units or over the full denture bases is the most important single factor in full denture construction. The controlling of these natural forces so that during function every muscular contraction may be utilized to retain the dentures in position constitutes our major problem.

It has been previously pointed out that the mandible describes a series of arcs, during the various functional movements.

It was further observed that the architectural form of the dental system bore a direct relationship to this type of movement.

When full dentures are to be made, it is essential that they be designed and constructed in accordance with nature's developmental plan, if, during function, the applied stresses of mastication are to be properly distributed over the dentures. The artificial teeth used must be arranged so that there will be no occlusal interference while the mandible is moving in its natural paths of travel from the centric position. The teeth must also be placed in relation to the ridges so that during mastication the dentures will not be dislodged.

Fig. 7.—Triangle (heavy line) representing mandible in centric occlusion. The angles at the base of the triangle are in the positions occupied by the condyles in the glenoid fossae, while the apex of the triangle occupies the position of the lower central incisors in centric occlusion.

For the purpose of studying just how the applied stresses should be distributed over the dentures, it is helpful to divide the dentures into two segments, as illustrated in Figure 9, one, the anterior segment, comprising the twelve anterior teeth, and the other, the posterior segment, made up of the sixteen posterior teeth. The anterior segment, while regarded largely from the point of view of esthetics, must also be considered from the standpoint of tooth arrangement, so that, during mandibular movement, the dentures will not be dislodged because of an excessive overbite. The posterior segment becomes that area of the dentures over which all the applied stresses must be spread.

It is not my intent to deal with any definite method for full denture construction, but rather to confine the discussion to bio-engineering problems that are applicable to any good technic that the operator may elect to use.

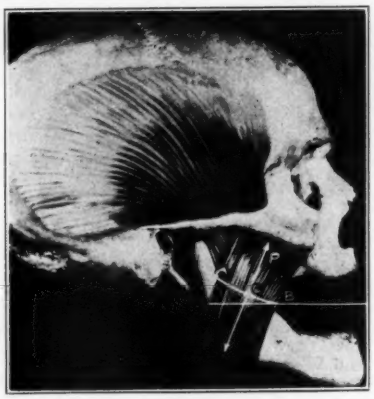


Fig. 8.—Loss of teeth, with result that only contact remaining between cranium and mandible is through medium of condyles.

Before the teeth are set up on the trial dentures, it will be supposed that some satisfactory method has been employed of paralleling the occlusal rims, or bite rims, to the patient's plane of occlusion; also that the operator has correctly registered the centric relation and that the casts with the registration in the correct

centric relation are mounted on an anatomic articulator.

After the anterior teeth have been placed in position, and tentatively arranged to meet esthetic requirements, the posterior teeth are set up on the trial dentures, care being exercised to see that there is established both the anteroposterior, or compensating, curves and the lateral, or transverse, curves. Both sets of these curves are extremely important, if a proper distribution of the applied stresses of mastication is to obtain, without excessive traumatic occlusion when the dentures are put in motion.

Figures 10 and 11 show the compensating and transverse curves now incorporated in the trial set up. The operator must bear in mind, and make provision for, certain other factors, while arranging the teeth in the wax. Among these are: the direction and amount of mandibular movement, the proper relation of the teeth to the ridges and the correct amount of anterior overbite and anterior overjet.

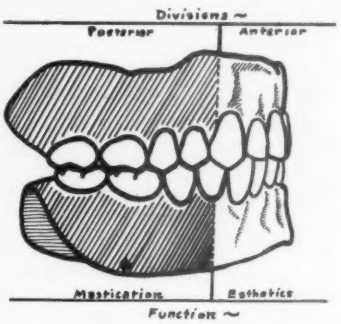


Fig. 9.—Division of dentures into two segments for purpose of studying how applied stresses should be distributed over dentures.

These points will be discussed separately. The first to be considered will be anterior overbite and overjet.

It has been previously pointed out that when the mandible moves laterally to the right or to the left from the centric position, the path of travel is forward and laterally. Knowing this to be a fundamental fact, one sees how the "locked in type" of anterior tooth arrangement shown in Figure 12, left, will cause excessive anterior leverage.

The instant the mandible is put in motion during mastication, it starts to move forward and laterally. This forward component in lateral mandibular movement continues until the lateral masticating excursion is complete. In employing the "locked in type" of overbite, the lower anterior teeth immediately come in direct contact with the lingual surfaces of the upper anterior teeth. Naturally, there are produced forces which tend to dislodge one or both of the dentures.

Fig. 10.—Compensating curve incorporated in trial set up.

Anterior vertical overbite and anterior horizontal overjet in combination will be discussed after consideration of anterior overjet as shown in Figure 12, center. To some, this type of anterior tooth arrangement is known as horizontal overbite.

The purpose of anterior overjet seems to be greatly misunderstood, and the amount to be used in any given case seems to be a problem to a great many operators. In the natural denture, the amount of anterior overjet found is always governed by the anterior ridge relations. In other words, if the mandible is underdeveloped, the anterior

overjet will be great. On the other hand, if the natural anterior teeth are end to end, when in centric occlusion, there will be no anterior overjet. The same rule should govern the amount of anterior overjet used in the arrangement of artificial anterior teeth. Cases in which an unduly large overjet would be produced by placing the artificial anterior teeth in the same relative positions that the natural teeth occupied will be given special mention later.

We have become so accustomed to using sets of artificial teeth that are manufactured with the linear dimension of the upper set of teeth in fixed ratio to the

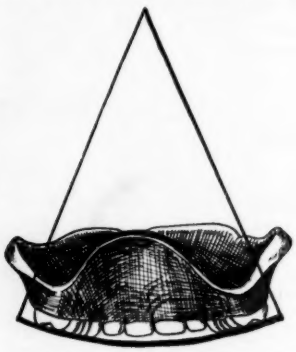


Fig. 11.—Transverse curve incorporated in trial set up.

lower set that we have failed to weigh the engineering or functional value of the overjet. The artificial sets in combination are carved without proportioning out the linear dimension of each combined set, so as to provide for anterior overjet.

Do you realize that we rarely, if ever, see patients whose teeth are in contact, unless they are asked to close in centric occlusion? Patients, when not masticating, relax the mandible to a rest position, completely obliterating the vertical overbite present. No matter how great the actual overbite may be, what we really see is only the amount of overjet that is present. For esthetic purposes, it makes little difference whether we employ overbite or not, in full dentures. It will not be seen if we do use it, unless we ask the patient to close the teeth in centric occlusion. If it is indicated, we must use overjet in order to meet the individual esthetic requirements. While it is possible to use anterior overjet alone, without using anterior overbite, from an engineering standpoint anterior overbite should be employed in full denture construction only in combination with anterior overjet.

During mastication, the mandible glides downward, forward and laterally. The amount of downward displacement

Fig. 12.—Right, correct amount of anterior overbite and anterior overjet in combination.

of the mandible, incorporated in the lateral-forward movement during mastication, will be in a direct ratio to the cusp height of the posterior teeth.

Figure 12, right, shows the correct amount of anterior overbite and anterior overjet in combination. The amount of both that should be employed in any set of full dentures will depend on the cusp height of the posterior teeth selected; and also on a proper placing of the anterior teeth to allow for a free space that will permit the lower anterior teeth to clear the upper anterior teeth during the downward displacement of the mandible. Properly used in combination, anterior vertical overbite and anterior horizontal

overjet prevent the anterior teeth from coming in direct contact during function, and allow all the stress of mastication to be directed onto the posterior segment of the dentures.

Figure 13 shows a trial denture cut in half, through the median line to illustrate how overbite and overjet are used in combination.

Figure 14 shows the proper combination of overbite and overjet for this case viewed from below. The use of a locked-in type of overbite, without sufficient overjet, is probably the greatest single cause of denture failures. Repeatedly, dental technicians will relate that they put the proper amount of both overjet

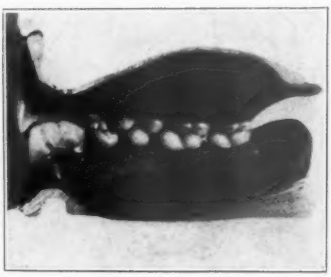


Fig. 13.—Trial denture cut in half through median line to illustrate how overbite and overjet are used in combination.

and overbite in their set-ups, only to have the case come back after being tried in with the upper anterior teeth pushed back against the lower anterior teeth. When dentures are constructed with a locked-in anterior tooth arrangement, the patient, if he can use them at all, will be limited to an open and shut movement only.

Figure 15 and the following quotation are taken from an article by Dr. MacMillan:

The artificial tooth, which is of less diameter than the natural tooth, occupies the same relative position on the artificial denture as in the natural denture as far as the location of the lingual surfaces are concerned. The location of the buccal cusp of the artificial tooth brings the line of action of the load medially from the fulcrum, thus creating a lever of the third class. The denture is effectually stabilized through the pressure of the denture base of the opposite side—not the teeth of the opposite side.[1]

The clinical application of this engineering principle to practical denture construction has proved that it is fundamentally sound. Figure 16 is a diagram showing the relative positions of the lower posterior teeth when the molars are placed lingually to the center of the

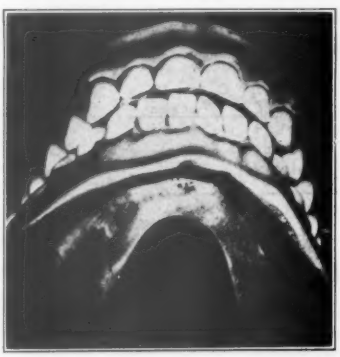


Fig. 14.—Proper combination of overbite and overjet viewed from below. (Compare Fig. 13.)

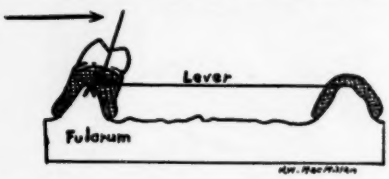
ridge. By virtue of the additional stability gained by this method of tooth arrangement, it is possible to place the bicuspids in their natural position, which was slightly toward the buccal aspect of the center of the ridge, without causing the dentures to be dislodged by the applied stress during mastication.

Expanding the arches in the bicuspid region improves the esthetic values as it

1. MacMillan, H. W.: Clinical Application of Unilateral Balance to Prosthetic Dentistry, J.A.D.A., 18:1029 (June) 1931.

permits the use of larger and more natural appearing anterior teeth. It also gives a greater and a more normal space for the tip of the tongue to function. In the molar region, the tongue, during function, has only limited movement, and this movement has a general tendency toward its constriction, while, at the tip, the tongue is very active when aiding in the functions of speech and the control of food in the mouth.

One other engineering advantage gained by this type of lower posterior tooth arrangement that is often overlooked is the fact that it provides better clearance for the forward movements of the mandible without causing cusp interference. When the posterior teeth on both sides are arranged more nearly parallel to each other, a natural path of travel is furnished for the protrusive excursions of the mandible. In this same connection, Figure 17 illustrates how the upper molars should be placed, with the mesiobuccal surfaces turned buccally enough to provide guidance and clearance for the lower posterior teeth to travel forward during the protrusive movements of the mandible. The proper positioning of multicusp posterior teeth will greatly minimize the amount of grinding necessary to eliminate cusp interference and procure protrusive balance after the dentures are inserted.



Lever of the Third Class
Denture base on the opposite ridge – not the teeth – provides balance.

Fig. 15.—Lever of third class. The denture base on the opposite ridge—not the teeth—provides balance. (After MacMillan.)

In beginning this presentation, it was pointed out that two major problems confronted the operator when he attempted full denture construction: that of constructing full dentures that (1) would aid in restoring function to the dental system and (2) would continue to aid in function as changes took place in the mouth after insertion.

In considering the first problem, a practical summary has been given of the engineering advantages of keeping the applied stress of mastication directed onto the posterior segment (molars and bicuspids) of the full dentures so that these forces may be utilized as an agent of retention in keeping the two denture bases seated on the ridges. It has been shown that, in order to load the dentures properly, the occlusal curves must be made to coordinate with the curvature of individual mandibular movements and that the teeth must be properly placed and so arranged that, during mastication, no dislodging forces will be originated.

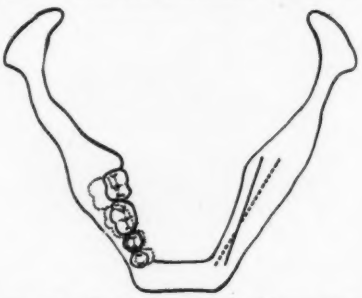


Fig. 16.—Relative positions of lower posterior teeth when molars are placed lingually to center of ridge.

But now let us pass on to the other problem, that of maintaining a proper distribution of the applied masticating

stress over the posterior segment of the dentures, as the various tissue changes take place in the mouth. This will involve a study of the relation that tissue resiliency and absorption bear to vertical dimension and also as to what relation vertical dimension bears to centric occlusion.

The term vertical dimension, as it is known in full denture construction, means the interdental space or the distance between the ridges of the mandible and the maxillae. To Addison K. Parks, of Montgomery, Ala., must go a great deal of credit for the research he has done on vertical dimension and its importance in full denture construction. In his work, Dr. Parks has shown that when the interdental space is shorter than normal, as the bite continues to close from any cause whatsoever, the mandible arcs forward. As the ridges absorb, or as the bases settle into the tissue, we naturally have a shortening of the bite. Under such circumstances, the centric occlusion position will constantly shift forward with each degree of closure. The anticipated rapidity with which the vertical dimension may be lost, after insertion of the dentures, can be used as a guide in selecting the mechanical treatment that will best serve the case at hand. A complete report of Dr. Parks' work on this subject can be found in Nichols' Textbook of Prosthetic Dentistry, chapter 19.

Fig. 17.—Placing of upper molars with mesiobuccal surfaces turned buccally enough to provide guidance and clearance for lower posterior teeth to travel forward during protrusive movements of mandible.

Figure 18, left, shows occlusal rims built to proper height and marked for the purpose of recording what occurs to the centric relation, if, from any cause, the vertical dimension is shortened. Figure 18, right, illustrates the same case after a loss of interdental space. You will note from the recording marks that the mandible has arced forward, and also that the original centric relation has been lost. In order to clear up any misunderstanding relative to what has happened, bear in mind that this arcing forward of the mandible, due to closure, is entirely independent of any functional protrusive movement of the mandible. The condyles are always in contact with the posterior wall of the glenoid fossae. The condyles in this case are an axis about which the mandible has arced forward.

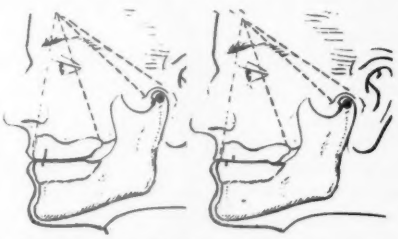


Fig. 18.—Left: Occlusal rims built to proper height and marked for purpose of recording what occurs to centric relation if vertical dimension is shortened. Right: Same case after loss of interdental space.

Figure 19 shows a patient wearing dentures with lost vertical dimension. Figure 20 shows the same patient wear-

ing dentures which restore the vertical dimension.

The amount of forward arcing of the mandible, produced by a change from a given vertical dimension to one shorter, can be readily seen after a comparative study of the picture.

The two principal conditions that operate to shorten the vertical dimension, after the insertion of dentures, are absorption of the ridges and the resiliency of the supporting tissues. Another factor in the loss of vertical dimension is the amount of occlusal correction necessary to produce balanced occlusion following vulcanization.

Naturally all of the conditions which operate to produce shortening of the vertical dimension will vary with each individual case.

Fig. 19.—Patient wearing dentures with lost vertical dimension.

Figure 21, left, represents full dentures at the time of insertion, with all the posterior teeth in correct interdigitation. Figure 21, right, shows how an arcing forward of the mandible affects the original centric occlusion position. The cusps of the lower teeth strike on the occlusal inclined planes of the upper teeth. To use dentures for mastication, under these conditions, will give rise to many dislodging forces, as the patient brings the two dentures into correct interdigitation. These dislodging forces are the origin of severe trauma, which, when transmitted to the underlying bone cells, is the cause of much ridge absorption. Viewed from an engineering standpoint, the only possible way dentures made with cusp posterior teeth can be used as the vertical dimension is lost is by having the supporting ridges absorb enough to allow the bases to move about as the cusps of the lower teeth slide over the occlusal inclined planes of the upper posterior teeth into the correct interdigitation. Here, we see a vicious cycle produced.

Fig. 20.—Patient shown in Figure 19, wearing dentures which restore vertical dimension.

The more the vertical dimension is shortened, the more the ridges are destroyed. In many a mouth, the fact that the original ridges are nothing but a mass of resilient hypertrophied tissue is mute evidence that destructive trauma has been in operation. Another contributing factor in the loss of correct tooth interdigitation is the fact that the ridge absorption of the maxillae is not only on the crest of the ridge, but also on the labial and

buccal surfaces. This allows the upper base to travel upward and backward. After the dentures are inserted, any ridge change permits the two dentures to drift in opposite directions; which, of course, will disturb the cusp interdigitation originally established.

Along with this matter of loss of vertical dimension, after the dentures are inserted, is the fact that the anterior overbite has a tendency to increase with each degree of closure.

When the condyles serve as an axis during any opening or closing movements of the mandible, a point farthest from the axis (in this case, the lower incisors) will travel the greatest distance through space. In the case of full dentures, a given amount of loss to the vertical dimension in the molar region produces a much greater degree of closure in the incisor region.

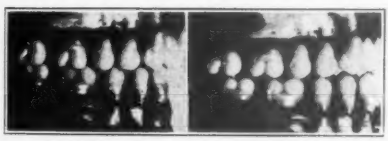


Fig. 21.—Left: Full dentures at time of insertion, with all posterior teeth in correct interdigitation. Right: Arcing forward of mandible affecting original centric occlusion position.

A common example of this is a door as it swings on its hinges. In the closing or opening of the door, the point farthest away from the hinge will travel the greatest distance through space.

The operator who is concerned about the proper distribution of stress over the dentures should anticipate this matter of increasing vertical overbite, and arrange with his patient before attempting to construct dentures for any necessary correction of the anterior overbite, when it becomes too great. A clinical procedure that I have used for many years has helped in the matter of controlling anterior overbite after the dentures are inserted. It was first brought to my attention by the late Loomis P. Haskell, of Chicago. The procedure consists of having the anterior teeth just out of contact, during any functional movements of the mandible, at the time the dentures are delivered to the patient. The clinical application of this method of anterior tooth arrangement in full denture construction needs only a trial to prove that it is practical.

In conclusion, it might be pointed out that as we approach the problem of making a set of full dentures for any patient, our first thoughts should be directed toward existing mouth conditions. We have seen the importance of the proper distribution of the stress of mastication and the value of converting these forces into an agent of retention.

It has been further pointed out that, in order to maintain the original centric occlusion, it becomes necessary to also maintain the original vertical dimension.

After giving the patient a mouth examination, we can determine to what extent such factors as ridge absorption or tissue resiliency will interfere with maintaining a constant interdental space after the dentures are inserted.

If we expect a great amount of ridge absorption, or if the resilient tissue is abnormally thick, we cannot expect to have much success in retaining the established vertical dimension, which, in turn, means that the original correct centric occlusion cannot be controlled. A treatment that employs cusp interdigitation is contra-indicated in these cases.

All abnormal cases, such as those wherein the ridge relations are out of proportion, either bilaterally or unilaterally, or ridge conditions are unfavorable for stabilizing the denture bases, as well

as all cases in which closing of the interdental space is anticipated after the insertion of full denture, may best be served by cuspless or mechanical teeth.

In the latter group of cases, the cuspless teeth will more satisfactorily accommodate for the constant change in centric occlusion caused by the arcing forward of the mandible as the vertical dimension becomes shorter.

Each edentulous patient exhibits varied and complex problems that must be solved. A better understanding of the bio-engineering factors involved will be of assistance in planning and constructing full dentures (irrespective of mouth conditions) that will properly distribute the applied stress of mastication, and thus convert this vital force into stabilizing and retentive agents during function.

CERTIFIED AMALGAM ALLOYS: A.D.A. SPECIFICATION NO. 1*

Samples of all amalgam alloys certified to the Research Commission of the American Dental Association by the various manufacturers were purchased in the open market by the Research Commission and tested by the A.D.A. Research Associates at the National Bureau of Standards. As of May 4, 1935, the following list of alloys were found to comply with American Dental Association Specification. Alloys which did not comply are omitted from this list.

FOURTH SURVEY OF ALLOYS

May 4, 1935

Alloy	Manufacturer or Distributor
Argentum (shavings)	Hammond Dental Mfg. Co.
Aristaloy	Baker & Co., Inc.
Banner (filings)	Goldsmith Bros. S. & R. Co.
Blue Diamond (filings)	Reliance Dental Mfg. Co.
Brewster medium (shavings)	E. R. S. Brewster
Brewster quick (filings)	E. R. S. Brewster
Brewster quick (shavings)	E. R. S. Brewster
Certified	Lee S. Smith & Sons Mfg. Co.
Coe	Coe Laboratories, Inc.
Dee (filings)	Thomas J. Dee & Co.
Excel	Daniels Dental Alloy Co.
Keystone	Lee S. Smith & Sons Mfg. Co.

*Paffenbarger, G. C., and Sweeney, W. T.: Specifications and Certifications for Dental Materials, J.A.D.A., 21:658 (April) 1934.

*Released May 4, 1935, by the Executive Board of the Research Commission of the American Dental Association; C. T. Messner, Secretary, U. S. Public Health Service Building, Washington, D. C.

Minimax (filings)	(shavings)	The Minimax Co.
172	173	
173	177	
174	178	
177	180	
178	161	
180		
181		
183		
161		
Minimax white gold & platinum		The Minimax Co.
Mission No. 5		San Diego Smelting & Refining Co.
Modeloy (quick setting) (filings)		Crescent Dental Mfg. Co.
Ney-Aloy		The J. M. Ney Co.
Odontographic "improved" (filings)		Odontographic Mfg. Co.
P.D.Q.		Patterson-Hettinger Co.
Preferred D		Precious Metals Refining Works
Preferred C		Precious Metals Refining Works
Royal-Special first setting		Garhart Dental Specialty Co.
Silverex		Interstate Dental Co., Inc.
Silverloy (filings & shavings)		Crescent Dental Mfg. Co.
Speyer		Speyer Smelting & Refining Co.
S-C medium (filings)		Stratford-Cookson Co.
S-C quick (filings)		Stratford-Cookson Co.
True Dentalloy (filings)		S. S. White Dental Mfg. Co.
True Dentalloy (Cut A)		S. S. White Dental Mfg. Co.
Twentieth Century (filings)		The L. D. Caulk Co.
White Beauty		Lang Dental Mfg. Co.

A METHOD TO INSURE THE QUALITY OF OUR WORK

By HENRY A. KELLEY, D.M.D., F.A.C.D., Portland, Maine

AT a recent meeting of the New England Dental Society, Richard M. Smith, M.D., of Boston, Mass., read a paper entitled "The Future of Dentistry and Medicine in the Economic Program." Dr. Smith was a member of the committee which made the "Five Year Study of the Costs of Medical Care." In this paper, Dr. Smith said that "most of all, some machinery should be brought into operation and utilized to guarantee the quality of work done and to aid the public in making the right contacts with competent practitioners." It was this part of his paper that I discussed. My ideas were said to be so wholly revo-

lutionary and I received so much favorable comment on them that I have thought it well to prepare this brief article for the sake of the record if for nothing more. The plan is very simple and I believe worth while. I am afraid it will be many, many years before the ideas are put into operation.

I agree with Dr. Smith that the necessity of keeping up the quality of work both in our profession and his is one of the prime necessities of the present age. In this era of attempting to get something for nothing, to live on or out of our government, etc., it is hard to preach the doctrine of value received. And, even in professional life, it is hard to get men and women to live up to the Code of Ethics, which says "A dentist's (or physician's) first duty shall be the welfare of his patient." And this, together with the teaching of what I consider false dental economics, causes me to maintain with Dr. Smith that there is great danger of reducing the quality of our work. In fact, I might say it has, I believe, already begun.

We take great pains to see that one who would begin the practice of dentistry is well fitted to do so; but after he is safely by the state boards of registration, what do we do to see that he keeps up the quality of his work? Absolutely nothing! We leave him to his conscience. Can we do anything about it? Most assuredly we can, and this is what I propose.

I believe that the present plan is wrong. The state of Massachusetts, for instance, has granted to Harvard University the right to maintain a department for the education of dentists, but after Harvard has graduated these men, the state says that they cannot begin practice, not even in Massachusetts. They must further show their fitness to begin practice by coming before the Massachusetts State Board of Registration in Dentistry and demonstrating that they are fitted to practice their chosen profession. I contend that this is wrong. Either the State of Massachusetts should accept as fitted to begin the practice of dentistry a graduate of a school that it has chartered or else it should revoke the charter of a school which is unfitted to do that for which it was granted the charter. Nearly all of our dental schools are now "Class A" and the time is, I think, not far distant when they will all be so classed. At least, we could demand that they all must reach this classification. Then it is my contention that the diploma from any American "Class A" dental school should be *prima facie* evidence that the graduate is fitted to begin the practice of dentistry anywhere within the jurisdiction of the United States of America. This also would take care of our troublesome question of reciprocity and would do away, of course, with the present duties of our state dental examination boards.

Now I would require of the recent graduate, and from this time on of all graduates, that every five years from the date of his graduation, he come before a state dental board and pass such an examination as the board shall decide is necessary to show that he is now fitted to practice dentistry in this country. In the course of time, we should thus have every dentist coming before an examining board every five years as long as he cares to remain in practice. This, I feel, would result in a great improvement in the quality of the work of men practicing over a long period of years and of men who for one reason or another do not keep the quality of their work up to the standard which they reached at the time of graduation.

This plan of mine is, of course, similar to the regulations governing Army and Navy officers. For example, a young man

is graduated from Annapolis and, without further examination, is accepted into the United States Navy; but he knows that, in due time, he will be ordered before a board of examiners for promotion. And so he goes on all through his career from one grade to another, always with the knowledge that, sooner or later, he must stand an examination for promotion. Thus, he is compelled all his life to be a student of his profession, and if he fails to pass his promotion examination, there comes a time when he ranks so far below the grade that he should occupy for the opportunities for advancement that he has had that he is dismissed from the service as unworthy to remain. The Army has a little different method from the Navy, but here also promotion tests are constantly ahead of one.

SUMMARY

There is need that something be done to insure that dentists keep up the quality of their work throughout their professional life. It is recommended that (1) all dental schools attain and maintain "Class A" efficiency; (2) only graduates of these schools be allowed to practice in this country; (3) in any part of the U.S.A., a degree from any of these schools be accepted as evidence that the holder is fitted to begin practice; (4) all practicing dentists be compelled to appear before a board of dental examiners five years after graduation from the dental school and periodically thereafter, and (5) the present state boards of dental examiners be reorganized and have placed in their hands the operation of these ideas.

655 Congress Street.

A DENTAL TUMOR ASSOCIATED WITH DENTAL ABNORMALITY: REPORT OF CASE

By F. JOSEPH GELPI, D.D.S., Denver, Colo.

SINCE, at the present time, classification of dental tumors is not entirely satisfactory, an accurate discussion of these pathologic conditions offers obvious difficulties. When the Anatomic Society met at Basle, Switzerland, in 1869, to devise a scientific medical nomenclature, Broca introduced the term "odontoma" to include all new growths having their origin in the dental organs, irrespective of their physical characteristics. This term has been accepted and now has the sanction of universal usage.

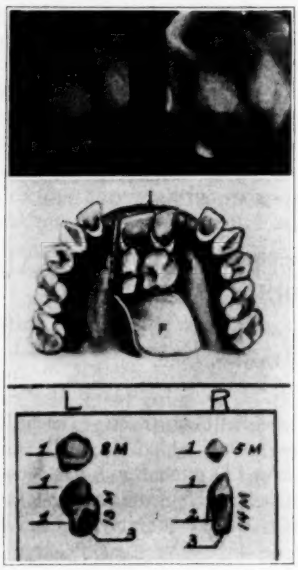
Of the various classifications attempted since Broca's time, that of Dennis seems most satisfactory. It has the advantages not only of brevity, but also of description. He divides odontomas according to origin and cellular structures as follows: (1) epithelial odontoma, (2) fibrous odontoma, (3) cementoma, (4) radicular odontoma and (5) composite odontoma.

The epithelial odontoma (Dennis) is analogous to Brophy's "enameloma" and, according to most authorities, arises from profileration of the epithelium of the enamel organ. Mechanical, nutritional or any other form of irritation may be the etiologic factor. Benign in character, these lesions cause little if any pain or inconvenience, and while there is no infiltration into adjacent structures, the effect of pressure and expansion must of necessity produce abnormal changes in these tissues. Epithelial odontomas are not rare and are found as frequently in

the maxillae as in the mandible. Age apparently is no factor in their occurrence. The prognosis is favorable if the tumor is removed in its entirety. Early recognition and removal are of great importance as the following case report indicates.

REPORT OF CASE

July 2, 1933, a boy, aged 11, well nourished and well developed, came in for a dental examination and consultation.



Above: Roentgenograms of case. Center: Flap laid back exposing underlying structure after removal of bony process. Below: *1,* enamel; *2,* dentin; *3,* myxomatous tissue.

Roentgenograms, as shown in the accompanying figure (above, left) and taken in February of the same year, confirmed the condition found in the mouth. The upper central incisors had not erupted, and the two deciduous central incisors and the left cuspid were still attached to the soft tissues. This was not the only important feature of the examination. From the boy's actions, it became apparent that we were dealing with a serious behavior problem or the lad was suffering from some incipient disease of the nervous system. Inquiry into this phase of the case revealed a history of violent hysterical outbursts or emotional storms of some type or another. These matters are noted because of the subsequent course of events and because they were of comparatively recent origin.

The two deciduous central incisors and the one cuspid were removed. A week later, the patient was discharged, being instructed to return within three months for further observation. This he failed to do. Oral examination and roentgenograms (above, right), a year later, indicated without a doubt that the permanent incisors could not erupt normally. Digital examination revealed the incisal edges of these teeth at the mucobuccal fold and the roentgenograms suggested either supernumerary teeth or drifting second bicuspids, as the cuspids and first bicuspids were fully erupted.

Surgical interference was decided on. The illustration in the center represents the incision with the flap laid back and the underlying structures exposed after the bone process had been removed. The left incisor, lying in a parallel position with the posterior line of occlusion, was firmly wedged at the dentino-enamel junction by a large irregular odontoma measuring 8 by 13 mm., which, by its position, exerted an upward pressure. This mass (as shown in the view below) had adhering to its posterior surface a small amount of myxomatous-like tissue. The right incisor, parallel with the left, was wedged at the same point and subjected to a like pressure by a well-formed cuspid measuring 5 by 14 mm. with a short hollow root containing the tissue previously described. A portion of this tissue was cultured and incubated. No growth was obtained. Retention stitches were removed in forty-eight hours and the flap firmly sutured with no medication of the cavity attempted.

The patient made an uneventful recovery

and, fifteen days after the operation, the crown of the right incisor had appeared through the gum tissue. The mesial angle of the left incisor erupted in normal position six days after the right. Fulness, due to edema, which had been present over the lower portion of the face and most marked under the nose before the tumor was removed, was now noticeably absent and the child rapidly returned to his normal state.

The importance of early recognition and removal of dental tumors must be emphasized. Early surgical interference will definitely eliminate many of the abnormalities now seen in the adult. Also, attention is directed to the condition of the nervous system, which may be caused by some irritative focus, as was the case in this instance. This case tends to stress the possibility of dental irregularities as etiologic factors in a small percentage of the so-called behavior problems in children of school age.

Explaining California

A number of bills are before the California legislature, including six or seven bills for compulsory sickness insurance, one bill opening all the hospitals of the state to all the people regardless of ability to pay, and another licensing corporations to practice medicine in California. Moreover, the state is overrun with cultists of various types and with all sorts of corporation practice, group practice, club practice, industrial practice and similar schemes. The survey made jointly by the California State Medical Association and the interim committee of the senate, like most such surveys, hardly seems to have scratched the real surface of medical conditions, yet the results of the survey are cited in support of the action to which the various bodies concerned in the legislation seem to have been rather largely committed before the survey was undertaken. It is clear that the Milbank Fund and other foundations have been active in propaganda in California. As the onlooker from without, the editor would venture the prediction that all will not be so rosy in California as it may now seem to the bespectacled, rose-colored vision of some of the proponents representing the California Medical Association. It should be obvious from the statements that have been made and the hearings that have been held that the very factors in medical care which the profession will demand will not be favorably received by the political group, who will eventually dominate the sickness insurance system in California. The dental profession, some assert, has received inadequate consideration in the proposed legislation and will perhaps oppose the bill that has been offered. The medical profession will perhaps find itself ultimately in a situation in which it will have to oppose the legislation for which it is now responsible, mainly because it decided to compromise rather than to fight to the finish on the principle and the issue. A complete study of all that has occurred in California indicates to any one who has some understanding of our American political system the difficult path which the leaders of California medicine are treading. Perhaps they will find their way successfully out of the morass without engulfing their profession in a system which will lead to a lowering of the standards of medicine and the quality of medical care in that state.—*J.A.M.A.*, May 4, 1935.

The Journal of the American Dental Association

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C. N. JOHNSON, Editor
NEWTON G. THOMAS, Associate Editor

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Editorials

A FEW QUESTIONS

The people of this country have been listening so long to tales of woe that it is high time they turned about face and took stock of themselves. A large part of our population are in grave danger of an almost utter demoralization if they do not bring themselves up with a turn and begin to face facts. And some of the facts of the recent past are to the effect that many of our citizens are rapidly going soft. The moral fiber of the American people is in grave danger of disintegration and collapse. Irreparable harm has already been done, and the end is not yet unless a quick change is made to recover our self-respect and our manhood.

The dole is rapidly sapping the foundations of our body politic. It is making mendicants out of able-bodied men, and doing a definite harm to a large number of our citizens. There is one thing that in the past has made the people of this nation hold up their heads and face every emergency of life undismayed and with a bold front, and that thing is pride. Men have taken pride in their independence

of character and in their individual initiative. They have asked no quarter when it came to fighting the battles of life, and they have stood four-square to the world, and bared their breasts to whatever fate had in store for them. The recent slur that has been gratuitously hurled against the so-called "rugged individualism" of the American people is as wide of the mark as political slogans usually are, and it has served nothing but an unworthy purpose. It was this same kind of individualism that made this country what it was in the days when the nation most needed men of character and initiative, and without it the people never would have achieved the status that has been theirs. This nation was built on the principle that every man should give a fair day's work for a fair wage, not that a man should hold out his hand and accept dole and do nothing. Times without number, the principle has been promulgated that the moment an able-bodied man reaches out his hand and accepts something for nothing a moral disintegration begins in that man that is the inevitable forerunner of defeatism and failure. If there is illness or incapacity that is another story.

No need to tell us that there are certain individuals in every community that require help, and that are entitled to help. We know that, and have always known it—more's the pity. Not only that, but in our own profession we have seldom been found wanting. Witness the manner in which the profession rallied to the aid of the San Francisco sufferers at the time of their disaster. Here was a concrete example of spontaneous and legitimate succor in time of emergency and it was a fine chapter in dental history. In this very connection, there was an aftermath to that story that is very significant and very wholesome. It is something to think about in these latter days when the prevalent clamor is to demand more and more help, and to show so little disposition on the part of certain of our beneficiaries to dig their way out of their difficulties and become self-reliant.

When the stricken San Francisco dentists had become rehabilitated and placed on their feet, they had too much self-respect and too much pride to demand or accept another dollar. No, they carefully conserved the remnant of the fund that had been collected for them, and it was this remnant that formed the nucleus of the present magnificent Relief Fund of the American Dental Association.

Think of the spirit behind these two occurrences—first the generosity of the dentists of the country who so loyally came to the aid of their stricken fellow members, and second the essential high-minded honor of the men who had been helped, when they resolutely turned their backs on relief the moment they could shift for themselves, and immediately began to devise means for the protection of others.

That was only a few years ago, just a mere fragment of time in the evolution of society. What has happened since then to so change the prevalent tendencies of the hour? Is the dental profession itself in danger of going soft? Are they developing into a lot of whiners just because they have suffered some reverses? Will they not look a difficulty in the face and accept it with some philosophy? In the vernacular, can they no longer "take it on the chin"?

The thing for this profession to do and for this nation to do is to stop whining and go to work. Of course, we shall at once be told that this is very impractical and very wrong, that we are not sympathetic with the misfortunes of our fellowman, and that we do not know the situation anyhow. But we *are* sympathetic, and we *do* know the situation. It is because we know it so well that we lament the fact that so few are taking advantage of the proper American spirit to bring about a remedy.

Where are the men who built this nation? Where are the men who organized our own profession, and placed it on a stable basis of ethics and professional rectitude? What has become of the principles of responsible government when a public office was a sacred trust? Think of the stalwarts of the nation, and of the dental profession. Did they demand the dole or reach out a hand expecting something for nothing? Did they countenance chicanery in government or chiseling in politics? Did they turn their wistful eyes toward the mirage of state aid in problems that they should solve themselves? Did they whine when the buffets of fate struck them a blow that at the time seemed irreparable? Think back on San Francisco.

The time is rapidly approaching, if it is not already here, when the expenses of government will mount so high that our citizens who pay the taxes simply cannot survive under the staggering blow. The relative percentage of government employes who are feeding at the public crib compared with the taxpayers who are bearing

the burden is fast growing so grotesquely large that it is a serious menace to the welfare of the people. Yet the merry dance of governmental extravagance goes on, apparently without a thought of the consequences, mortgaging the future with an abandon worthy of the mental acumen of a lot of mad men, apparently oblivious of the homely fact that the chickens must inevitably come home to roost; toying with such wild vagaries as state medicine and state dentistry, advocating impractical insurance schemes of all kinds that never have worked and never can work, human nature as it is.

Dentists are supposed to be possessed of at least the average intelligence of our citizens at large. The mental training that is given them in preparation for their professional practice should equip them to think logically on the current questions of the day. Then it should no longer be considered incongruous for dentists to concern themselves with the issues of government or to speak their minds on any subject that vitally affects the people. The time is past when dentists should assume an attitude suggestive only of the cloister or the laboratory. They should be prepared and be willing to go out and battle valiantly with the problems of the hour, and assert their rights to be heard on any and all of the pressing issues that are so vitally affecting the welfare of the people.

Let us turn about and face our difficulties, and if necessary face our foes. Let us not lend countenance to the siren song of state this and state that as applied to our professional problems. We are under no greater stress either financially or politically than were the pioneers of our country or of our profession. Today let us exhibit some of the same spirit that animated the pioneers, and see if we cannot surmount our difficulties as they did.

THE CURRICULUM SURVEY STUDY

The report of the Curriculum Survey Committee of the American Association of Dental Schools has just been issued. It consists of a volume of 412 pages, and it has been in process of preparation for several years.

The Curriculum Survey Committee consists of the following:

Wallace Seccombe, chairman, Toronto; John T. O'Rourke, secretary, Louisville; Arthur D. Black, Chicago; H. Edmund Friesell, Pittsburgh; Harry M. Semans, Columbus. There were two educational advisers, W. W. Charters, Ohio State University, and Floyd W. Reeves, University of Chicago. Lloyd E. Blauch was made executive secretary, with headquarters at 311 E. Chicago Avenue, Chicago, Ill.

An imposing array of subcommittees and associates, or reviewers, were called in to assist in the development of the study, numbering nearly 100 men.

The evolution of dental education from its beginning with the first dental school nearly a century ago (1839-1840) to the present time has been marked by a very creditable rate of progress. It is hardly too much to say that our profession both in its educational development and in the evolution of its practice has proceeded with greater rapidity and more pronounced advancement than any other calling in the given time of its organization.

Various associations and agencies have contributed to the development of better methods in dental education: the Institute of Dental Pedagogics, the Dental Faculties Association, the Dental Examiners Association, the Dental Educational Council of America, the Carnegie Foundation for the Advancement of Teaching, and the American Association of Dental Schools. It was the last-named association that appointed a committee known as the Curriculum Survey Committee, and it is the very comprehensive report of this committee that we have before us.

The report makes it clear at once that it was far from the aim of the Curriculum Committee to attempt finality in its presentation. It says: "It was not the intention of those engaged in this study to present a *final* curriculum in dentistry. No such curriculum can be prepared now or at any other time. No course of study, however well it may be designed or however solid may be its foundation can ever be final. Constant adjustment of the materials of instruction to new principles and needs is a problem that is ever present with the progressive educator."

With this clearly announced premise, no logical educator can have any quarrel. In fact, one of the most conspicuous manifesta-

tions in dental education has been the very rapid and almost spectacular development in our dental curriculum. The dental school of today embraces a curriculum at least three or four times greater in extent and detail than the curriculum of even a decade or two ago. The moment that this is acknowledged, and it must be acknowledged, it is clearly seen that there was an imperative need for the closest possible study of the dental curriculum.

The committee has gone at its work with seriousness, and with as great a uniformity of results as was possible with the diverse and sometimes complicated problems that confronted it. The rapid evolution of dental education has placed a pronounced strain on our educators, and it has been no small task to systematize and harmonize the various problems that have arisen in such rapid sequence.

The present report embraces something more than a mere study of curriculum as presented in the dental schools. In certain of its sections, it furnishes a rather clear-cut study of the science and art of dentistry as conducted by the general practitioner of dentistry, whether of a few or of many years' standing. Chapter II on "Oral Health Conditions" is a conspicuous example of this. This chapter would furnish food for thought for any man or woman practicing dentistry regardless of affiliation with a dental school or with the process of dental education.

But the chief aim of the study is announced in the following statement: "The entire curriculum in dentistry has been considered not as a series of unrelated subjects, but rather as a well-integrated program for the education of students for dental practice." For, after all, the object of any study of this kind, or of any study whatsoever connected with the problem of dental education, should have direct relation to the most approved and most effective means of preparing students for practice. Sometimes in a laudable desire to impart instruction to students in dental school and to make them well-rounded, educated men, we may lose sight of the essentials for training them for actual service in the dental office. This may be one reason that some of the recent graduates enter practice inadequately equipped to meet the emergencies that inevitably arise in professional life, and conceivably it may explain why a certain percentage

of them fail. Yet failures cannot by any means be attributed wholly, or even in an appreciable degree, to lack of instruction in college. The schools today are preparing students for life service in a more acceptable manner than ever before, and when the results of the present curriculum study are properly formulated and generally put in practice, it is confidently expected that teaching in dental schools will enter a more proficient era, and meet a wider demand.

Many other phases of this report might profitably be discussed if space permitted; for instance, the need for orientation in dentistry. the relationship between medicine and dentistry and the pressing question of social and economic problems as they relate to professional life.

In the appendix, some observations are made on the views of laymen regarding our profession and its practitioners, and while they may contain little that is significant or enlightening as they relate to a curriculum study, they are of sufficient interest to merit at least passing notice.

ROOT CANALS AND PULP

A study of root therapy makes one turn to the preservation of pulps. It might be well to see what the field has to offer. Seventy-five years ago, Black[1] sought a way out of his perplexity in the same direction. In 1870, he reported forty-two cases treated in 1860. In eight years, thirty-eight of the teeth were pulpless. "The healing power of the organ is very low," he said. "If a touch is sufficient to draw blood the pulp will be destroyed." Such was his conviction on the subject that when Witzel[2] advocated the excision of the pulpal bulb, Black called the practice pernicious.

In 1921, the shadow cast by Black lifted sufficiently for Davis[3] to resort to pulpal resection. He reported pulpal repair, elaborating on Witzel, and demonstrated a formation of a calcified protection after the manner of bone repair. His treatment of pulps never be-

1. Black, G. V.: Special Dental Pathology, Chicago: Medico-Dental Publishing Co., 1915.
2. Witzel, Adolph: Compendium per Pathologie und Therapie der Pulpakrankheiten des Zahnes, 1868.
3. Davis, W. C.: Pulpotomy and Partial Pulp-Canal Filling, D. Summary, 41:116 (April) 1921.

came popular, probably because of its difficulty; probably because of the dominance of textbook pedagogy.

In 1919, Howe wrote of root-canal therapy thus[4]: "The whole of this much discussed field may be eliminated by the preservation of this vital organ of the tooth." He said further, "Infection is not the governing factor, it is secondary. Tissue condition is the deciding thing." He then tells how to restore injured pulps to a defensive state. Finally, he says

> Although an extremely sensitive organ . . . the pulp has the ability to repair itself, to dispose of a reasonable amount of infection. The bacteria are disposed of in the usual way (blood serum and intracellular digestion). The tooth building cells, the odontoblasts, may be again activated and secondary dentine deposited. In persons of good health, it seems perfectly reasonable to conclude that pulp conservation can be carried out successfully. Out of 934 pulps capped at the Forsyth Infirmary, eighteen came back for further treatment.

It is evident that Howe's optimism has as frail a rootage as Davis' pulpotomy. The literature echoes and reechoes with the ancient thesis of small reparative power, the very early age below which success may be expected and the easy death of the pulp.

Three-quarters of a century ago, workers saw that pulps, under unknown stimuli, occluded canals by structural or amorphous calcification. Caush, Salter and Tomes depicted such formations. Much later, Hatton[5] showed pulpal activity after laceration from broaches, the application of medicaments and the penetration of guttapercha cones. Skillen shows similar cases and denotes the remaining pulp squeezed between filling and dentin wall as "apparently normal."[6] To the imaginative, this held out possibilities. Evidently, there are conditions in which the pulp does not die after slight hemorrhage. Under some circumstances, an abused, traumatized, tortured pulp fights for its life successfully. If the apical half or third of a pulp is capable of so much recovery and function, why not the occlusal third? Howe's optimism would seem to have some foundation. Next after the vanquishment or control of caries, this consummation might be most desired.

At this juncture, another shadow falls across the endeavor to save

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4. Howe, P. R.: Conservation of Dental Pulp, D. Items Int., 41:933 (Dec.) 1919.
5. Hatton, E. H.: Histological Studies, D. Cosmos, 70:250 (March) 1928.
6. Skillen, W. G.: Status of Treated Tooth, J.A.D.A., 13:291 (March) 1926.

pulps. We are told by Ellingham[7] that pulps under large fillings, pulps that have become fibrotic from irritation, may be infected and infective. Speaking of a case in point, he says, "The patient would have been better off if the tooth had been 'frankly dead.'" In support of this thesis, he quotes Rickert. He does not explain why a fibrotic pulp that shows no neoplastic proliferation or necrotic tendencies should be more dangerous than the fibrotic tissue associated with other scars. He does not explain how tissue able to maintain a norm of structure and vitality without such changes can be so vitiated. Strongly infected tissue that shows neither change is anomalous.

Root therapy has made tremendous progress in the treatment of accessible teeth. Such men as Hall, Blayney and Coolidge have done brilliant work in this field. Blayney says that treatments carried out by students under his direction in cases that have been constantly observable are 77-80 per cent successful roentgenographically and in terms of the patient's health. No fight similar to that made on the pulpless tooth has been made in behalf of the pulps of teeth. The task bristles with difficulty, but so do root therapy, prevention of caries and other issues of the dental practice. Says Rickert[8] of the success of the first: "It is now seldom necessary to extract single rooted teeth." But the salvaging process must go beyond "single rooted teeth." Pulp saving, to be successful, must not exclude the multiple rooted teeth.

This short review with only enough names to support its structure indicates that the possibilities of pulp preservation are far from exhausted. With rare exceptions, the work that has been done is weighted with a negative obsession that antedates the endeavor. An expectancy of failure pervades it. The few who have labored otherwise did not labor long enough. No formula will ever be developed that is sworn always to succeed. There must needs be failures, but it is our task to increase the number of successes and make their probability more and more certain.

T.

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7. Ellingham, G. H.: Bacteriological Investigation into Some Filled Teeth, Brit. D. J., 58:108 (Feb. 1) 1935.
8. Rickert, U. G.: Fundamentals of Successful Root Canal Treatment, J.A.D.A., 14:1657 (Sept.) 1927.

WARNING AGAINST INTERVIEWERS

The *Presse Medicale* of Jan. 12, 1935, calls attention to the methods employed by American advertisers to obtain statements, later distorted, from prominent European physicians in an endeavor to sell their wares. A suave representative interviews the professor or physician and "utilizes these conversations in altered form as recommendations of the particular drug or food product which the interviewer represents." The interview is then published and the various titles held by the professor, with his photograph added to attest the genuineness of the endorsement. The photographs of all leading medical men on the continent of Europe are on sale at the medical book stores, so that it is unnecessary to ask for a photograph for insertion in the advertisement.[1]

It is a common practice for advertisers to give advertising a scientific appeal. A man in white pores over a microscope or holds a test tube to the light. And nowhere has scientific truth been more misused and distorted than in the exploitation of the dentifrice.

The dentifrice industry, the largest investment of which is represented by advertising, has conditioned readers of respectable periodicals and newspapers and radio listeners to look for scientific virtues in almost every dentifrice; despite the fact that the assertions are often at variance with each other and that no proof could be found for most of the commonly advanced claims.

The trading in testimonials is still on, not in the crude fashion of other days, but with greater refinement. A "scientific" gentleman makes a call. After a brief introduction, he takes a prepared statement from his pocket, and without further investigation, asks the dentist to testify to the accuracy and honesty of the statements prepared by the advertising agency "scientists." The dentist is assured that the statement over his name will not appear in advertising, but he is not assured that misleading inferences will not be drawn that the cure for the new found condition mentioned in the statements lies in the tooth paste.

The American public have been conditioned to "film" and its horrors, "4 out of 5 have it," "pink tooth brush," "acid mouth," "sali-

1. J.A.M.A., 104 (March 2) 1935.

vary stimulus" and "7 stains," and one advertiser is trying to force the "bad breath" of his advertising on his readers. If a recent experience is an indication of what may happen, the dental profession and the public may soon look for "receding gums"; that is, if enough dentists can be induced to sign a testimonial. In the light of what the *Press Medicale* reveals in Europe and what the sign boards show here, dentists who appreciate the value of their time and the value of their opinions will be justified in showing the "scientific" gentlemen above mentioned the door.

T.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Separation—Request patients to turn the thumbscrew of the separator, observing the separation in progress. Self-inflicted pain hurts less than pain inflicted by the dentist.—*Leonard C. Borland, Chicago, Ill.*

Removing Tin Foil from a Denture—Tin foil is quite easily removed from foiled denture cases by contact with mercury. Care must be taken to keep mercury clear of all gold work such as clasps and bars and exposed teeth pins.—*Robert M. Peters, Lansing, Mich.*

Contouring and Polishing Silicate Fillings in Anterior Teeth—In pressing silicate fillings to place by use of a celluloid matrix, very little lingual polishing will be required if the matrix is burnished down to the level of the lingual surface of the tooth at the cavity margin while the filling is plastic.—*Robert M. Peters, Lansing, Mich.*

Polishing Occlusal Surfaces of Inlays—With a prophylaxis brush shaped into a cone, polish with Tripoli paste, followed with pumice. With a piece of chamois about an inch and a quarter long, cut a triangle, the base being about one half inch wide, and wrap around a tapered fissure bur and apply rouge to the finishing polisher. Complete the polishing with the chamois cone.—*A. H. Balcer, Shaker Heights, Ohio.*

Prejudging Patients—Prejudging purse contents is problematic. Patients often wear old clothes to obtain lower estimates. Paying for an examination is foreign to them. The dentist should make a casual examination, give a tentative elastic estimate and apply the usual examination fee as a deposit on future work. Patients appreciate interest shown and attention given. To return to get the benefit the deposit made is a natural tendency.—*Herbert Ely Williams, Red Bank, N. J.*

Is There an Answer?—With feminine patience and an upper plate or denture broken in half, a patient called at a dental office. The plate had been worn "as is" for more than a year. How could it fit? It did not have to—she had fitted herself to it. Herein lies one secret of all successful prosthesis. Adequate adaptation is a dental task—tissue fitting to the plate or denture is decidedly the patient's contribution. The dentist creates, while the wearer wears and fits. Such a combination assists in solving the denture problem.—*Herbert Ely Williams, Red Bank, N. J.*

The Single Operation—Studied caution must be exercised in accepting the single operation patient, unless he be a transient living elsewhere. Should a resident prospect seek our services requiring a single extraction, experience prompts us to defer it, if possible, until the end of the restorative work, at which time we might have had an opportunity to establish evidence of our operative skill. Dental ability is often judged not only by what we do, but what we see fit to omit temporarily. One is more likely to have a flare up with a single extraction than with a dozen.—*Herbert Ely Williams, Red Bank, N. J.*

Aid to the Removal of Models from an Articulator—When models are fastened to an articulator with plaster of Paris, they may be readily removed as follows: A small piece of pink baseplate wax the width of a laboratory knife and of sufficient length to warrant proper leverage in twisting is laid on the bottom of the casts before these casts are mounted on the articulator. When the casts are to be removed, the knife is heated and forced into the wax "wedge" and a twisting motion dislodges the model with little danger of a fracture, as may happen when the model is hammered off the articulator.—*Robert M. Peters, Lansing, Mich.*

Broken Jaws vs. Fractured Alveolar Processes—Genuine cases of broken jaws are rare, but unfounded reports of them are frequent and distressing. If teeth are a part of the jaw, every extraction of a firm tooth means a modified fracture of the jaw itself. This is more apparent when a spicula of process accompanies the extraction. If dentists explained the anatomy involved, patients would be less liable to circulate harmful, misleading reports about competent dentists. When patients read them and believe them, printed leaflets on after-care are most helpful, explaining what to expect and what to do about it.—*Herbert Ely Williams, Red Bank, N. J.*

Immediate Dentures—In making immediate dentures, we find that the care in setting the teeth up in the natural position is fundamental for esthetics. We have also found that the anatomic contour of the labial portion of the alveolar ridge, especially of the upper anterior teeth and the bicuspid region, is also individual. By duplicating the individual structure of this portion of the ridge covering the roots of these teeth, the facial form is not altered, and the lip, base of the nose and general mucosa do not have to adjust themselves to a new formed labial portion of the denture. The method of transferring the form to the artificial denture, we have developed according to our own ideas. It is a transfer of the anatomic impression directly to the cast, using an indirect impression of the same in plaster transferred to the flask. This also aids in making a more accurate and tolerant alveolectomy, deviating from the radical as far as possible.—*E. E. and F. J. Svoboda, Cozad, Nebr.*

COUNCIL ON DENTAL THERAPEUTICS

ACQUIN TABLETS—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

The Oval Laboratories, St. Louis, Mo., successors to the Claussen-Zoller Company, submitted Acquin Tablets to the Council with the statement that the Oval Laboratories purchased from the receiver of the Claussen-Zoller Company all rights to the use of Acquin Tablets, covering trademark, copyrights, name and everything else connected with Acquin.

It is stated that Acquin Tablets have the following composition:

Acetphenetidin, U.S.P.	3 grains
Acetylsalicylic acid, U.S.P.	3 grains
Caffeine alkaloid, U.S.P.	¼ grain

It will be noted at once that Acquin Tablets are the well-known "A.P.C." mixture, which is listed in most catalogs of pharmaceutic manufacturing houses. The "A.P.C." tablets have been marketed to the public either directly or through the medium of the medical and dental profession under various names.

The firm submitted a sample letter that they propose sending to dentists, from which the following is taken:

"Many dentists are, unconsciously no doubt, using anodynes containing quinine. Quinine being incompatible with acetyl-salicylic acid—forming quinotozin, under certain conditions, which is a poison, should never be administered to patients suffering with post-operative pains, headaches, anticipated pain or in cases of pain whatsoever the cause may be."

The theory that quinine and acetylsalicylic acid form a toxic compound when combined was advanced some years ago, but the assertion has not been upheld.

No evidence is available that this "A.P.C." mixture will do more than properly regulated doses of each of the analgesics alone. An examination of most "A.P.C." formulas shows that there is contained in one tablet, in addition to a dose of acetphenetidin, part of an "average" dose of acetylsalicylic acid. Essentially the same effects may be obtained by increasing the dose of any of the active components.

Acquin (Claussen-Zoller Company) was the subject of seizure in 1930 under the Food and Drugs Act because false and fraudulent therapeutic claims were made in its promotion. (Notice of Judgment 16940.)

In view of the foregoing, Acquin Tablets are declared unacceptable for Accepted Dental Remedies; i.e., because a complete statement of composition is not given on the label (Rule 1); tests for determining the active ingredients are not given (Rule 2); it is advertised directly to the public, and to the public through the dental profession (Rules 3 and 4); the source of the material is not stated (Rule 5); no evidence is made available that the mixture of acetphenetidin, acetylsalicylic acid and caffeine present in Acquin Tablets, as in other "A.P.C." tablets, is more useful than either of the active ingredients alone (Rule 6); the name does not properly describe the composition (Rule 8), and it is an unnecessarily complex mixture for the purposes indicated (Rule 10).

POLORIS TABLETS—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

The Council has repeatedly emphasized the potential dangers inherent in the indiscriminate use of acetanilid, acetphenetidin, acetylsalicylic acid, barbital, etc., and the fact that their use for the relief of pain encountered in dental practice should be under the immediate control of the dentist or physician. The Council has also warned dentists to be on guard against unwittingly advertising old combinations of these drugs put out under new names. The Council further pointed out that the drugs enumerated above have a legitimate place for use in the relief of pain—a fact which has since been reemphasized in Accepted Dental Remedies—and that there was no convincing evidence available that combinations of acetphenetidin and acetylsalicylic acid were more efficacious than properly regulated doses of each.

To the long list of "pain relievers" is now added another, Poloris Tablets. These were introduced in the stereotyped manner—disparaging the old and tried drugs and attributing to the new product virtues that supposedly are not to be found in the official drugs.

Dentists are told:

Poloris Tablets contain acetphenetidin, acetylsalicylic acid and other valuable ingredients perfectly balanced to give safe positive relief from pain, insomnia, migraine and nervous disturbances. Poloris Tablets are an effective anodyne, analgesic, antipyretic and antarthritic in action.

The outstanding recommendation of Poloris Tablets is that our salicylic acid releases slowly, the chemical split-up being purposely delayed so that the full therapeutic action takes place in the duodenum, instead of the stomach. This avoids gastric distress and irritation of the stomach caused by other pain tablets. The heart and stomach are not affected by Poloris Tablets. They are non-narcotic and non-habit forming.

Poloris Tablets are said to contain: acetphenetidin (acetanilid derivative), 2 grains; acetylsalicylic acid, 3 grains per tablet, and other valuable ingredients perfectly balanced. The other ingredients were not stated in the early advertisements. More recent advertising states that caffein is present. This is in accord with the findings of the A.D.A. Bureau of Chemistry. An examination of the product indicated that each Poloris Tablet was made up essentially as follows: acetphenetidin, 2 grains, acetylsalicylic acid, 3.5 grains, caffein and starch for binder.

Thus, it is seen that "Poloris Tablets" is just another name for the well known A.P.C. combination which has been marketed for years and prescribed by certain physicians. There is no evidence available that such a mixture will do more than either of the active ingredients, properly prescribed, alone. There is no convincing evidence available that these mixtures exert their antipyretic or analgesic effect other than by an additive effect.

How much of an addition to the materia medica Poloris Tablets are may be seen by comparing their formula with the following formula taken from the catalogs of two large pharmaceutic houses:

	1	2
Acetylsalicylic acid	3	3½ grains
Acetphenetidin	2	2½ grains
Caffein	½	½ grain

When these tablets are purchased in bottles of 1,000, the cost is approximately $7.10; when they are purchased in larger quantities, the cost is, of course, smaller. It is no secret that large pharmaceutic and specialty houses will package and sell these combinations under protected names. This may help explain the free distribution of clinical samples, so-called, of this and similar products.

In view of the foregoing, Poloris Tablets are declared not admissible to A.D.R.; i.e., because a complete statement of the active ingredients does not appear on the principal label (Rule 1); they are advertised to the public through dentists for use in conditions that require competent professional care (Rule 4); unwarranted claims are made in their exploitation (Rule 6); the name does not indicate the composition (Rule 8), and the mixture is unnecessarily complex and therefore irrational (Rule 10).

SODIPHENE—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

In July, 1931, the secretary of the Council wrote to the Sodiphene Company, Kansas City, Mo., marketers of Sodiphene, that the Council was about to consider Sodiphene and would review any evidence submitted regarding the product. To date, no reply has been received.

Sodiphene was considered by the Council on Pharmacy and Chemistry in 1929 and was held not acceptable for New and Nonofficial Remedies because it was an unscientific, needlessly complex mixture marketed under a nondescriptive name, and without a statement of composition on the label, and presented no originality entitling it to a proprietary name, and unwarranted claims were made for it.[1] A statement of composition does not appear on the label of the product now marketed.

It is stated that Sodiphene has the following composition:

"Phenol, 4%; Sodium Hydroxide, 1%; Cassia Oil, 0.01%; witch hazel, 0.10%; boric acid, 0.08%; alcohol, 0.20%; wintergreen oil, trace."

The Council on Pharmacy and Chemistry said: "There is no evidence that, in the amounts present, the cassia oil, witch hazel, boric acid and alcohol have any therapeutic effect, and the cassia oil acts as a flavor only." Therefore, the preparation was considered an alkaline phenol solution containing sodium phenolate rendered unscientific and needlessly complex by the addition of witch hazel and boric acid. Alkaline phenol solutions were in use a great many years ago, but their use generally has been discontinued.

Sodiphene is advertised to the public as a germicide. As such, it does not transgress the rules of the Council regarding lay advertising of antiseptic and germicidal preparations to the public, provided the claims are limited to conservative recommendations for use as applications to superficial cuts and abrasions of the skin and to the mucous surfaces of the mouth, pharynx and nose.

To the profession, the Sodiphene company has advertised itself as having the authority of the U. S. Department of Agriculture to place on its packages the terms "antiseptic" and "germicide," presumably because it passes the test of the Food and Drug Administration. It is well known that the Food and Drug Administration does not object to the word "antiseptic" or "germicide" on the label, provided the solution so labeled will kill *Bacillus typhosus* in five minutes. It is too well known that this organism is not a factor in dental disease nor does the presence of a mouth wash in the mouth simulate test tube conditions. The Council desires to point out that as far as germicidal activity in the oral cavity is concerned, there is no satisfactory evidence that mouth washes, *as they are used,* do anything more than cause a temporary decrease in the number of bacteria not attached to the teeth or gums. The use of such terms as "germicidal," "antiseptic" and "disinfection" in advertising a mouth wash is definitely misleading. Laboratory tests published to date do not and cannot show the value of any antiseptic solution under prac-

1. J.A.M.A., 93:381 (Aug. 23) 1929.

tical conditions. Accordingly, statements as to their germicidal value should be considered with this in mind.

Unwarranted and misleading inferences that Sodiphene is the universal antiseptic are made:

> There is no secret why Sodiphene produces such remarkable results [results not stated], nor to the fact that it is effective in such a wide variety of cases. [Kind of cases not stated.] Carbolic Acid has always been, and continues to be, the criterion by which antiseptics and germicides are judged. Its germicidal and analgesic powers are recognized the world over. Its caustic effect alone keeps it from being the universal germicide. *You can therefore appreciate Sodiphene's effectiveness when we give you our assurance that it is a 4% phenol solution,* with all the germicidal and analgesic properties retained and the caustic effect eliminated.[2]

Despite this assurance, Sodiphene will do no more and no less than a 4 per cent alkaline solution of phenol. Against the typhoid bacillus, it is stated to have a phenol coefficient of 0.04. In view of the fact that there are many preparations which are nonescharotic and have a higher phenol coefficient, the claim is unwarranted. The indiscriminate use of even a dilute solution of phenol may well be questioned, since it has been observed that if a finger or other extremity has dressings wet with even a dilute solution of phenol applied, gangrene is likely to occur. The recommendation "where teeth are abscessed or sockets infected use a blunt hypodermic syringe filled with Sodiphene full strength" is not without potential dangers, and is unwarranted. Carefully compiled evidence to warrant such a recommendation was not available in textbooks on exodontia consulted. Exodontists in general do not use a phenol solution as advertised in extracting teeth.

It is also mentioned for use as an adjunct in pyorrhea and in Vincent's infection. In view of the common knowledge that the irritant action and dangers of absorption from a solution of phenol have rendered its use unpopular where a large absorbent surface is present or where irritation is liable to be injurious, its use in the treatment of pyorrhea or trench mouth may well be questioned, especially when other less irritant drugs are available.

The rationality of daily use of a 4 per cent phenol solution is difficult to see, and the advisability of its continuous use is questioned. Solutions of phenol are known to retard the action of most enzymes. It is not readily conceivable why the mouth of the average healthy person is in need of such medication. Sodiphene is not a deodorant, but merely covers one odor with another.

The claim that Sodiphene is analgesic is a well-known assertion as regards phenol, but phenol, as an analgesic or topical anesthetic, has, in general, been replaced by less potentially harmful compounds for other than superficial operations.

Dentists appreciate that solutions for spraying and rinsing after operative procedure are useful almost wholly because of the pleasant taste they leave, and that the less potentially harmful preparations that are at hand should be used for this purpose.

In view of the foregoing, Sodiphene is declared not acceptable to A.D.R., i.e., because a statement of composition does not appear on the label (Rule 1); it contains a potentially poisonous substance (Rule 7); unwarranted claims are made for it (Rule 6); it is a well-known product which shows no originality entitling it to a proprietary name (Rule 8), and its use cannot be considered in the interest of the profession and the public (Rule 10).

2. Italics not in the original.

BUREAU OF PUBLIC RELATIONS

FILLING MATERIALS FOR CHILDREN'S TEETH*

By KENNETH A. EASLICK, A.B., D.D.S., Ann Arbor, Mich.

OUT in the section where I was born, the farmers still have the homely pioneer saying, "If the dog had not stopped to scratch a flea, he would have caught the rabbit." This saying could be applied to our practice of children's dentistry. If we had not stopped to insert so many temporary fillings in temporary teeth, we would have achieved adequate dental care for children long before the present time.

Any successful technic for managing a small child's carious teeth should be able to withstand at least three tests: Is it practical and simple? Is it rational? Is it adequate?

Anyone who includes children in his practice will subscribe to the test of practicality and simplicity without a question. The dentist often has to cut down his operating time in order to secure a consistent fee and he often has to simplify procedures to manage his young patient. A simple operative technic and short appointments are almost indispensable in a children's practice.

With the dental supply market literally burdened by products for filling deciduous teeth in a submarine environment, for filling these teeth with an enduring germicide, for filling cavities for which there is inadequate preparation or which have undisturbed leathery dentin in them, it is time that those practicing children's dentistry select deciduous filling materials rationally, on the basis of physical properties. It is time to cease making an irrational selection on the basis of the wonderful claims on the package label and to cease having to defend our selection.

If practitioners of children's dentistry are justified in urging the public to send its children to them at the tender ages of 2½, 3, 3½ or 4 years, they must expect to find some cavities at these ages. Two-surface cavities in the molars of children between the ages of 2½ and 6 years have to be restored by fillings which will last until 9, 10, 11 or 12 years, when these molars normally exfoliate. (Some of us have seen adult gold inlays which did not survive that long.)

Since operative dentistry for children has failed to such a large extent in the past on the test of adequacy alone, I am going to confine myself to a discussion of filling materials for children's teeth and their selection from the standpoint of physical properties. Without making any claim to personal infallibility, I shall discuss guttapercha, the cements—zinc, copper and silicate—the amalgams, tinfoil, matt gold and casting alloys.

It may sound ridiculous to list guttapercha as a filling material, but it has been so listed in comparatively recent litera-

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

ture on children's dentistry. Fraser,[1] at the University of Toronto, has shown that temporary "stopping," the form in which guttapercha is usually used, is readily penetrated by moisture. Baseplate guttapercha, carefully inserted, was found by the same investigator to be a satisfactory temporary filling, as far as permeability was concerned. In handling guttapercha, we must bear in mind that it expands on heating 14 times as much as gold and 16 times as much as a tooth crown, and that it contracts the same amount on cooling. A temporary stopping does not make a good temporary filling. Is it a logical procedure to seal in an arsenic devitalizing agent with it?

The use of the cements alone as filling materials for children's teeth on the basis of their physical and chemical properties can hardly be justified. They fulfil the requirement of simplicity beautifully. Anyone can mix a powder and liquid on a glass slab and pack the putty obtained into the cavity.

In adult teeth, we have done much worrying over the fact that apparently some of the cements kill dental pulps. This has not worried us so much in children's teeth. The copper cement era was one of the mileposts of operative dentistry for children, and it seemed for a time that we were to have a germicidal silicate epoch.

All the cement powders used in dentistry are modified oxides, usually of heavy metals. All of the liquids are practically the same modified orthophosphoric acid. An oxide will react chemically with phosphoric acid to make a phosphate. When this chemical reaction is complete, the cement is set and the new phosphate, with unreacted powder particles and any other products of the reaction, becomes a filling—a good filling or bad filling, this depending on its physical and chemical properties.

The zinc phosphate cements have many interesting properties, but one may sort out from the Bureau of Standards report, by Paffenbarger, Sweeney and Isaacs,[2] those properties which will determine the usefulness of these cements. In the first place, the crushing resistance, or the compressive strength, which a zinc cement will offer to chewing is low. The Bureau of Standards' report gave figures to show that this compressive strength was but one-tenth to four-ninths of that which could be expected in an acceptable silver amalgam.

Every cement examined by the Bureau was found to shrink on setting. In an hour, the child patient will be going around with a filling slightly smaller than the cavity.

Solubility in saliva is another factor against the use of zinc cements as permanent fillings. The same Bureau report shows the large amount of disintegration that various cement pellets manifest in distilled water or synthetic saliva. These three properties, low compressive strength, contraction while setting, and disintegration in saliva, explain why the zinc cements must be relegated to lining the cavity, setting an inlay and sealing in medicaments.

Of the various oxides, phosphates, chlorides, silicates and iodides incorporated in cement powders to make them germicidal, the black and the red copper oxides have been most used in children's dentistry. I cannot see why germicides are needed in a cement base, provided all carious dentin has been removed, the cavity sterilized and a nonleaking filling inserted. Locking the germicide in a safe

1. Fraser, C. Jane: Study of Efficiency of Dental Fillings, J. D. Res., 9:507 (Aug.) 1929.

2. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Preliminary Report on Zinc Phosphate Cements, J.A.D.A., 20:1960 (Nov.) 1933.

should not improve the safe. Any germicide to be effective must go into solution. When a filling dissolves in the saliva, it loses some of its value as a filling material. If we leave undisturbed leathery dentin in cavities or if we expect metallic fillings to leak in a short time, we are logical in using a germicidal cement, with the hope that it will take care of the situation. In our clinic, we remove all leathery dentin, and reduce an ammoniacal solution of silver nitrate in any deep deciduous tooth cavity and place in it a zinc cement base before inserting the metallic filling. We are not "putting the cart before the horse," and using eugenol (as has been advocated) before using the ammoniacal silver nitrate solution. Wiping out the cavity with eugenol first defeats the purpose of the sterilization, reducing the silver nitrate solution to fine black metallic silver particles before it has had a chance to penetrate the infected dentinal tubuli. This reverse method prevents a painful wince by the patient it is true, but if we are going to sterilize in this manner, why not give the eugenol a fair chance and leave the silver nitrate solution out?

Black copper cement is undoubtedly a germicidal filling material, but is quite soluble, quite irritating to the gum tissue and of low crushing resistance. My experience with it makes me agree with one of the older members of our staff that "it belongs to the Dark Ages of dentistry."

I have seen red copper cement retained in children's teeth for comparatively long periods, but I have not seen it retained with a proper contact or proper occlusion. We cannot place a permanent filling with it which will adequately serve at the same time as a means of preventing conditions demanding orthodontic care.

Among the silicate cements, a germicidal type has been advocated by the manufacturer as a filling material for children's teeth and a cementing medium for orthodontic bands. The germicide in this cement, though in minute amounts, produced a larger clear zone in an agar plate of mixed mouth organisms than any other germicidal cement tested by John G. Coggan, instructor in operative dentistry at the University of Michigan. This clear zone persisted over many transfers. But here again, one must ask, "Is a germicide essential?" The silicate cements, according to Ray,[3] show a negligible solubility in distilled water, a 3 to 12 microns per centimeter setting contraction when mixed by recommended technics, and an average hardness about one-twelfth to one-fourth that of the softest surface enamel. One of the products of the reaction of the silicate cement powder with its liquid is silicic acid, an irreversible colloid. When a silicate cement loses water by drying out, its silicic acid will never take up all the original water it contained. Several desiccations will result, eventually, in a porous filling and a marginal ditch.

In young permanent anterior teeth, we have little choice among filling materials. Silver amalgam is ruled out by color; gold foil cannot be malleted into a young tooth, and gold and porcelain inlays are very often impractical. This leaves most of us using the silicate cements. Similarly, for the sake of the appearance, the germicidal silicate cement will often be placed in the anterior deciduous teeth, especially in the mesial cavities of cuspids. Added to appearance is the assertion that the germicidal silicate sets more promptly than filling silicates, a statement which might very well be checked in the laboratory.

A digest of the literature on children's dentistry for the year 1932 was made to determine what the operators who were

3. Ray, K. W.: Behavior of Silicious Cements, J.A.D.A., 21:237 (Feb.) 1934.

writing on this subject were using for fillings. The greatest difference of opinion among these dentists seemed to regard the choice of copper amalgam or silver amalgam as a filling material for the bulk of cavities. About one-half used copper amalgam and the other half silver amalgam. A few mixed the two amalgams.

For years, when an operator thought of a permanent filling for a child tooth, he thought of copper amalgam, and began to heat some, if he didn't have it already prepared. Today, probably one-half the profession are using silver amalgam. Copper amalgam was discarded quite a long time ago as a filling material in the teeth of adults, but the idea persists that it makes an ideal filling for temporary teeth. Since it has been used so long, there are a number of fallacious ideas about it in the literature; for example, the cavity does not have to be dry; copper amalgam does not irritate the gum tissue; it may be placed under the free margin of a bleeding gum; it is quickly and easily inserted; it needs less retention than silver amalgam; it can be placed nearer the pulp than any other filling material, and it has no volume change. No cavity has to be dry, but most of us think it better practice to insert fillings in a clean, dry, sterilized cavity. Dixon and Rickert[4] have shown that copper amalgam pellets irritate a rabbit's skin to the point of caseation necrosis. Any filling material may be placed, with proper precaution, under a bleeding gum margin. Copper amalgam requires practically the same attention to the details of insertion as does silver amalgam to get its maximum advantage as a filling material. Copper amalgam shrinks as it sets. It is reported by Fraser[1] to lose 5.8 per cent of its weight after three months' soaking and to lose 48.0 per cent of its weight in two and one-half years' soaking. If copper amalgam shrinks as it sets and dissolves as it comes in contact with the saliva, it ought to require more retention than silver amalgam. Any metallic filling will kill the pulp if placed close to it. The setting change of any brand of copper amalgam, regardless of how the amalgam is manipulated, is a contraction.

The choice of either amalgam should not be based on opinions, but on actual physical properties. Fraser[1] found copper amalgam germicidal for fifty transfers over a period of two and one-half years. Silver amalgam is not germicidal. The average flow of copper amalgam test cylinders is one-fiftieth that permitted by the Bureau of Standards' specification for silver amalgam.[5] Copper amalgam does show a high rate of flow for the first three hours after being packed, but after that time it shows practically none. Along with this low flow, it exhibits a marked brittleness, which has often been claimed for silver amalgam. The average setting change for copper amalgam as determined by Coggan was about 6 microns per centimeter. Any satisfactory silver alloy, if properly manipulated, will give a desirable setting expansion. The crushing resistance of copper is less, though of the same order, than that of silver amalgam. Silver amalgam is not soluble in the saliva, but, according to Fraser,[1] copper amalgam is distinctly soluble over a period of time. Silver amalgam is susceptible to carving after a few minutes and to taking a permanent polish after twenty-four hours. Copper amalgam is not susceptible to carving at the time of insertion and will not retain a polish. Silver amalgam, if properly condensed against healthy dentin, will not stain the

4. Dixon, C. M., and Rickert, U. G.: Tissue Tolerance to Foreign Materials, J.A.D.A., 20: 1458 (Aug.) 1933.

5. Taylor, N. O.: Specifications for Dental Amalgam Alloys, J.A.D.A., 17:112 (Jan.) 1930.

tooth. Copper amalgam will often cause a bluish green stain. The thermal conductivity of the two amalgams, as far as one is able to predict from heat conductivity tables for the pure metals, is probably about the same. If one wants an alloy that is germicidal, has little flow, is quite brittle, contracts as it sets, dissolves somewhat in the saliva and is quite apt to stain the tooth, copper amalgam should be the choice. If one wants an alloy that is not germicidal, has a greater flow, but is still within the Bureau of Standards' specification,[5] expands as it sets, is insoluble in the saliva and is not apt to stain the tooth, silver amalgam should be selected.

The first permanent molar has received so much prominence in dental literature and so much advertising in lay literature that its place in our consciousness often makes us forget the other permanent teeth in the child mouth. Be that as it may, the first permanent molar is a highly important tooth to preserve and the gospel of prophylactic fillings is very much worth preaching. Silver nitrate, black copper cement, germicidal silicate, copper amalgam, silver amalgam, tinfoil and matt gold fillings have all been advocated at various times to take care of its retentive fissures. Silver nitrate reduction did not prevent caries in my own family. Any cement used will be subject to the limitations inherent in its physical or chemical properties. Why not insert immediately a permanent prophylactic filling?

The amalgams have just been discussed. We are using silver amalgam in our children's clinic for these prophylactic fillings. Practically every answer to the review of dentistry for children questionnaire favored the use of silver amalgam in the practice of prophylactic odontotomy.[6]

6. Questionnaire, Rev. Dent. for Child., 1:6 (Jan.) 1934.

Tinfoil has been advocated and its low temperature conductivity mentioned. Gold will conduct heat approximately five times as readily as tin; while copper and silver show nearly seven times the heat conductivity that tin shows. Both the oxides and the sulphides of tin are white. I am sorry that my test cylinders were not completed in time to run Brinell hardness and specific gravity tests: I am quite sure that these tests will show that tinfoil is a rather inadequate filling material as far as these two properties are concerned. In addition to these possible drawbacks, tinfoil requires much more care for insertion than does a plastic filling. In test cylinders, it showed a tendency to creep under the pluggers, often working out over the margins of the mold.

Matt gold is another substitute for gold foil about which attractive claims have been made by the manufacturers during the last two or three years. Brinell hardness tests afford some information about pure gold fillings, but give only an indication of surface hardness, which is based on the amount of work that we have actually done on the surface. The best physical property test of the adaptation and condensation of this material is the specific gravity or weight per unit of volume. The Bureau of Standards Research Paper No. 32[7] gives 19.4 gm. per cubic centimeter as the specific gravity of pure cast gold. Our gold castings showed 19.1 gm. G. V. Black[8] attained 19.4 with gold foil malleted into a fixed test cylinder, while the best I myself could attain was 18.7. When malleting gold foil into a test block supported on a cushion, G. V. Black secured 17.4.

7. Coleman, R. L.: Bureau of Standards Research Paper No. 32, 1928.

8. Black, G. V.: Operative Dentistry, Vol. 1, Chicago: Medico-Dental Publishing Co., 1908.

He concluded, from testing gold-foil fillings found in extracted teeth, that a filling below 15.0 was unsafe. One of the gold companies that is manufacturing and selling matt gold claims to have secured a specific gravity with their product, using hand pressure, of 19.99. My own test cylinders, packed very carefully with hand pluggers under conditions simulating mouth conditions, tested 13.5 to 14.0. This specific gravity is below the 15.0 gm. that G. V. Black would set as a minimum for a filling in the mouth. The tendency when using matt gold is to slight its condensation and adaptation because of its easy working qualities. I believe that neither a hardness or a specific gravity will be attained with it that will match that of an adequately malleted gold-foil filling. One might conclude his discussion of the use of gold in the fissures of young first permanent molars by asking, "How is the removal of the expensive gold filling going to be explained to the parents of the patient a year or two later?" Suppose it has to be drilled out to make way for the dovetail of a two-surface filling which interproximal caries makes necessary.

When Willett[9] called attention to a gold inlay with a simple cavity preparation as the ideal filling for deciduous molars, he stated that a platinum gold alloy should be used to make these spider-like castings. The current business depression has set us searching for cheaper casting alloys. A low fusing, tin-antimony-zinc alloy with the trade name "acolite" has been on the market for a long time. A comparatively new silver casting alloy is being marketed for inlays for children's teeth. Both of these cost less by the ounce than a gold casting alloy will cost by the pennyweight. I am going to make comparisons of tensile strength, elongation percentage and Brinell hardness. Tensile strength affords an idea of the ability of a material to withstand stresses of mastication which might cause an alloy to bend or crack; elongation percentage is a measure of its ability to be drawn over cavity margins, while Brinell hardness tells us something about resistance to flow when the force of mastication encounters it.

PROPERTIES FOR ALLOYS AND CASTING GOLDS

Material	Tensile Strength	Elongation Per Cent	Brinell Hardness Number
Pure gold	15,000	32	27
22-carat dark gold	35,800	19	54
Inlay gold for moderate occlusal stress	40,000	25	71
Inlay gold for heavy stress	52,000	20	105
Acolite	Not determined	0	47
Silver alloy	37,700	5	56

For the sake of comparison, the properties of these alloys might well be listed beside those for casting golds as shown in the accompanying table.

Acolite shrinks but 0.4 per cent when cooling from the molten to the solid state as compared with gold, which usually shrinks 1.25 per cent. It fuses at 480 F. To get the most accurate fits with it, a technic using a high plaster investment and 500 F. burnout can be recommended. The margins of an acolite inlay will not

9. Willett, R. C.: Improved Operative Technique for Deciduous Molars, D. Items Int., 53:489 (July) 1931.

draw. Most of the wires which were cast for elongation tests broke while being pulled out of their molds after casting. It may be a useful material in bulky castings, but it is so brittle that the buccal and lingual extensions on a Willett inlay can be snapped off by the fingers.

The newer silver alloy exhibits properties that would put it in the "soft" inlay classification of the Bureau of Standards.[10] Its elongation is very small, and it does not exhibit properties that would make it a very favorable material for the Willett inlay. The usual technic for casting the gold inlay alloys secures a good fit with this silver alloy.

One might also ask some more or less pertinent questions about the substitution of casting alloys for gold and about the use of gold inlays in deciduous molars. The largest item in a finished inlay is labor and overhead, not material. Just how significant is the outlay for a fourth or fifth of a pennyweight of gold in the final cost of a Willett inlay?

The second question one might ask is, "Are gold inlays indicated as a filling for children's deciduous teeth in the average office practice?" One must admit at once that the Willett inlay is ideal in many ways. It restores anatomic form accurately; it does not impinge on gingival tissue; it avoids deep undercuts and the use of a matrix; the preparation can be made painlessly with stones, and most of the work can be done outside the child's mouth. For a long time, the bulk of children's work is going to be done by the average general practitioner, who will have a struggle to get a fee for a deciduous inlay. Are we, then, who are teaching operative dentistry to students, justified in recommending the inlay as a routine filling for deciduous teeth?

10. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Inlay Casting Golds: Physical Properties and Specifications, J.A.D.A., 19:36 (Jan.) 1932.

CONCLUSION

I should like to repeat what I have already said: I am examining filling materials for children's teeth from the standpoint of physical properties. I am making no claim to infallibility in their selection. Anyone can read the literature on the subject as well as I can, and many of you have had much more clinical experience than I have had. I realize, too, that the selection of an operator often has much more to do with the type of restoration the patient gets for his tooth than has the type of filling material that his dentist uses. Nevertheless, I have purposely tried to provoke discussion and examination of the filling materials employed in children's teeth. If a given material behaves poorly in a physical laboratory, what basis have we to think that it will take on virtues immediately it is inserted in a child's mouth? If we select materials that have high crushing resistance, slight setting expansion and low solubility in a laboratory, are we not going to get the same properties in the mouth and have better fillings? If we select materials that have low crushing resistance, some setting contraction and a high solubility in the laboratory, are we not going to obtain these same properties in the mouth and obtain inadequate children's fillings?

816 South State Street.

THE BAD BABY MOLAR

A ONE ACT PLAY

By LON W. MORREY, D.D.S.

PLACE: *The Mouth*

TIME: *Today*

CHARACTERS: *(in the order of their appearance)*

1. THE LITTLE OLD WOMAN *who lived in the cave*
2. JACK CENTRAL, JILL LATERAL *(Incisors)*
3. JACKIE CUSPID HORNER
4. FIRST BABY MOLAR
5. SECOND BABY MOLAR *(The Bad One)*
6. SIXTH YEAR MOLAR
7. MISTRESS DIET
8. MR. TOOTH BRUSH
9. THE DENTIST
10. BICUSPID

ACT I

LITTLE OLD WOMAN *(dressed as in Mother Goose, standing just outside of large face):*

I'm the Little Old Woman who lives in this cave
And I've thirty-two children to make behave
To safeguard their health and keep them pure white
I must feed them and scrub them, morning and night.

CENTRAL *and* LATERAL INCISORS *make their appearance, as well as* CUSPID, *two* BABY MOLARS *and* SIXTH YEAR MOLAR.

CENTRAL AND LATERAL: We're Jack and Jill
We're never ill
We're big and strong and bright
The reason's plain
When we explain
We're brushed each morn and night.
We never eat
Much candy sweet
Our diet's coarse but plain.
Fresh milk each day,
A quart I'd say
And bread from whole wheat grain.

CUSPID: I'm Jackie Cuspid Horner
A sitting in the corner
Looking so sharp and spry
If I'm polished each day
In a regular way
I'll never ache nor cry.

FIRST BABY MOLAR: I'm little Baby Molar
A most important tooth
Some think just 'cause I'm little
I'm not of very much use.
But I must chew the baby's food
And grind it up so fine
So the Stomach can digest it
In the shortest kind of time.
So I must have the proper food
Not pie, nor sweets, nor cake
And I must keep myself real clean
So I won't have tooth ache.
And if I keep myself real strong
And polished smooth and bright
When my brother, Bicuspid, comes
He can stand in line just right,
For if I let myself decay
Why then, when I'm 'bout nine
Bicuspid won't have room to grow
And he'll come in out of line.

SIXTH YEAR MOLAR: I am the Sixth Year Molar
You all have heard of me
I am the most important tooth
There is in dentistry.
So feed me well and keep me clean
And I will last for life
But if you don't I will decay
And cause all kinds of strife.

SECOND BABY MOLAR *(The Bad One)* Ho, ho, ho, ho; ha, ha, ha, ha;
That's just a waste of time
What do I care if Bicuspid
Does erupt "out of line?"
I don't have time to wash myself
Besides it's not much play
To use a brush upon your face
And scrub two times a day.
It's nothing but a waste of time
A waste of money too
To bother with old Tooth Brush

Like all the others do.
And as for diet—what care I
I like my candy and my pie
Sugar and jam and cookies, too
The sweeter the better
I'll tell you.

Enter MISTRESS DIET *with basket laden with whole wheat bread, fruits, milk, vegetables, etc.*

My name is Mistress Diet
And much depends on me
I'll give you strength and health and wealth
Or I'll give you misery.
I'll make your body big and strong
I'll make you thin and frail
I'll make your cheeks a rosy red
Or I'll make you wan and pale.
On Diet much depends, my dears,
As you must surely know
For you must eat the proper foods
If stronger you would grow.

(Turns to face and proceeds to feed the teeth from her basket.)

Here is some fruit both rich and ripe
And whole wheat bread for you
And here's some nuts and here's some milk
And baked potatoes, too.
Leafy vegetables, fresh and green
Are good for teeth and health.
This diet, friends, will give you joys
Not bought by moneyed wealth.

(Gets as far as BAD MOLAR *who will not eat her food.)*

BAD MOLAR: No, no, no, no, I won't eat that
Bring me some cakes and pies
Whole wheat bread and fruits and milk
Are things that I despise.
I want some sugar cookies
Some candy rich and sweet
And all those leafy vegetables
Some other tooth may eat.

TOOTH BRUSH ENTERS:

My name is Mr. Tooth Brush
I am your friend indeed
And if you treat me as a friend
I'll fill a daily need.
For I will help to keep you clean
If used each morn and night

I'll help to keep you polished
And always shining bright.

(Proceeds to clean all the teeth until he gets to BAD BABY MOLAR.*)*

BAD MOLAR: Go 'way, go 'way, don't bother me
I've something else to do
For I must play and eat and sleep
And not fool 'round with you.
Toothbrushes are for sissies
But not for men you see
Go wash and scrub the others
Don't waste your time on me.

LITTLE OLD LADY:
O bother o' me, O bother o' me
I've one bad child who won't mind me
He's growing more dirty and head strong each day
I know he'll get sick and die of decay
He won't drink his milk, he won't eat his crusts
He won't eat his fruit tho' I tell him he must
He's naughty and dirty and bad clear thro'
I'm afraid he'll decay the rest of us too.

CURTAIN

INTERMISSION

(Dance, song or other specialty)

ACT II

BAD MOLAR: Ouch! Ouch! I have an awful pain
My stomach aches, my head aches
I think I'll go insane
Why should I have this trouble
When the rest of you are gay?
'Taint right for all those goblin germs
To bother me this way.

LITTLE OLD WOMAN:
Call a Dentist! Call a Dentist!
And see what can be done
Although he's been a naughty boy
A toothache is no fun.
(Puts bandage around crown of tooth)

DENTIST: *(Dentist comes, removes bandage and see the badly decayed tooth and swollen gums)*
Only one thing I can do for you
That's to extract you, it's the best I can do.

BAD MOLAR: No, no; no, no; that wouldn't be fair
To take me away and leave those there
Just give me a pill to stop this pain
And I'll keep myself clean, if you'll let me remain.

DENTIST: I'm sorry my boy, but you're far too late
You wouldn't keep clean so now you ache
For the good of the other white teeth in this row
There is only one answer—out you must go!

(Removes tooth amid pains, groans, etc. Tooth lies on back on floor. Doctor looks at molars on either side of extracted tooth, and finds decay starting in them due to contact with BAD BABY MOLAR)

Just as I thought. I had that fear—
That bad Baby Molar caused decay here
Now I must remove all this decay
And chase and drive the germs away.
Then fill up the holes with a filling new
Before we lose these molars too.

(With scissors he cuts black spots out of SIXTH YEAR MOLAR *and* FIRST BABY MOLAR *and pastes clean paper over spot. Retires.)*

SIXTH YEAR MOLAR: I wish that Baby Molar
Had kept real strong and clean
Then he would be beside me
And on him I could lean
Though I'm the Sixth Year Molar
As yet I'm rather weak
It's hard for me to keep my place
And stand upon my feet.

(He tips forward toward FIRST BABY MOLAR)

FIRST BABY MOLAR: O look at Sixth Year Molar
A rather weak young man
I guess I will move over
And help him all I can.

(Moves backward until both molars almost touch)

(BICUSPID *makes his appearance through the gums into the space left by the lost baby molar. Because the first baby molar and the sixth year molar have tipped toward each other partially filling the space, the bicuspid is badly crowded and comes in crooked.)*

BICUSPID: Hey there, you fellows you're taking my place
I wish you'd move over and give me some space.

SIXTH YEAR MOLAR: We are sorry, Bicuspid, but we're not to blame,
Baby Molar was careless, it's really a shame.

FIRST BABY MOLAR: He wouldn't wash nor brush himself
Nor eat the proper food
The dentist had to pull him
'Cause he wasn't any good.

BICUSPID: And now we all must suffer
Just through his lack of care

And I must stand 'way out of line
I'm sure it isn't fair
O why can't folks be careful
And their baby teeth retain
Until it's time to lose them
There is so much to gain.

LITTLE OLD WOMAN:

Yes, their health would be much better
Their looks and beauty, too
If they'd use a simple diet
'Tis an easy thing to do.
And then by careful brushing
Each morning and each night
Their teeth will remain healthy
And strong and clean and bright.
Please let this be a warning
To all who've seen our play
To guard your health and beauty
Diet and toothbrush must hold sway.

Song: Tune: Chorus of "Tramp, Tramp, Tramp, the Boys are Marching."

Scrub, Scrub, Scrub, are words of warning
Keep all the grinders shining bright
Choose your food with greatest care
And your brush you musn't spare
Keep them clean by brushing morning, noon and night.

CURTAIN

DENTAL ECONOMICS

A STATE PLAN TO PROVIDE DENTAL HEALTH SERVICE FOR THE INDIGENT, THE UNDERPRIVILEGED CHILD AND THE LOW INCOME GROUPS ONLY*

By JOHN S. OWENS, D.D.S., and JOHN G. CARR, D.D.S., Camden, N. J.

The following plan was presented as a suggested solution of the problem of dental health service for the indigent, the underprivileged child and the low income groups only, to the New Jersey State E. R. A. Dental Advisory Committee.

The chief feature of this plan is its recognition of organized dentistry and the use of organization channels for the control and distribution of dental service.

*Read before the New Jersey State Dental Society Board of Trustees, Trenton, N. J., Feb. 15, 1935.

It emphasizes that state dental societies should incorporate a state dental health service agency not for pecuniary purposes, to coordinate and administer existing and contemplated dental health service for these groups.

Its flexibility would make possible the adoption and use of various methods of dental service distribution to suit any locality, and either professional or governmental agencies or lay groups. It can be altered, extended or withdrawn by the profession. It will permit experiments in group dental health service under state dental society control and supervision.

We realize that no plan is a cure-all, nor could it be fool proof or complete in its solution of so large a service problem; but if we establish a viewpoint on control of dental service to these groups by organized dentistry, we shall have accomplished our purpose.

FOREWORD

The issue is health. What part does dentistry occupy in this issue of public health? The answer can be found in the relationship of oral health to general health. We believe that the following facts are of intimate concern to every citizen:

1. Dental caries is the most common disease to which man is heir.

2. The oral cavity is one of the most important points of entrance of disease. An unhygienic condition of the oral cavity is a primary factor in the etiology of many organic diseases and disorders. The oral cavity offers an ideal incubating place for bacteria, and as the entrance to the alimentary canal and in close association with the respiratory tract, proves an important factor in the distribution of disease.

3. All nutritive elements pass through the first stages of digestion in the oral cavity.

4. A sequence of organic and physical changes follows the curtailment, or loss, of function of the organ of mastication.

5. In youth, the development of the organ of mastication is frequently abnormal and irregular, with attending physical and mental disorders. Many of the organic and systemic diseases of adult life have their inception in dental infection in child life.

6. The proper care and use of the oral cavity and organ of mastication from infancy to old age is of supreme importance to health and happiness.

Planning the establishment of a state group oral-dental health service resolves itself into two methods of procedure:

1. Establishment by legislative action. This means that there will be governmental or semigovernmental control, lay control or professional control, or a combination of these. We, as citizens, do not believe that this problem is one for legislative action placing the control in any one of the above-mentioned agencies, or a combination of these agencies, for the following reasons:

(*a*) Because legislative action will tend to put the control in the hands of the unscrupulous politician.

(*b*) Because subsequent amendments, additions, changes, riders or other acts alter the original aims, purposes and objectives of the act.

(*c*) Because of exploitation of either the recipient or the profession.

(*d*) Because of the high cost of political administration.

(*e*) Because of personal or public aggrandizement.

(*f*) Because, if a section of the organization, such as the financial phase of the service, is allotted to a state or a lay agency and just the health service to the profession, organized or not, this organization will still remain political.

(*g*) Because, if the legislative measures are used to establish a group health service, a tax system is inevitable.

(*h*) Legislative action makes any plan irrevocable and permanent except through further legislative action.

2. Establishment without legislative action.

The control would lie within organized dentistry with or without governmental assistance. Organized dentistry would sponsor and incorporate a dental health agency for nonpecuniary purposes under existing incorporation laws.

There is every reason that organized dentistry should sponsor and set up this service. Who has a better right?

It might be well to review a few of the causes and accepted axioms of the profession with regard to this problem:

(*a*) It is the feeling of the dental profession that any group oral-dental health service should and must be proposed, operated and controlled by organized dentistry. The dental profession has a history of unsparingly caring for the needy.

In less than a generation, the concepts and objectives of the profession have passed from empiric service to scientific health service. The cost has mounted until scientific care is virtually prohibitive to the low income group.

It is through universal recognition of the need, of the inability to pay and of the lack of uniform distribution of dental service that the dental profession is faced with this new group oral-dental health problem.

(*b*) Any plan of service shall not interfere in any way with existing private practice.

It is the traditional and ideal method of rendering oral-dental health service because of its personal application.

Because the system is already in being, it is not necessary to evolve any new service system, and no large expenditure for base equipment is necessary.

(*c*) Any plan of service should and must, in order to receive confidence from the lay group participating, be sanctioned by the government, preferably state government.

(*d*) Organized dentistry does not endorse a compulsory insurance plan.

The solution of a group oral-dental plan, its financing, scope, quality and care is a problem for organized dentistry. Matters of general policy should be outlined by the American Dental Association, but, in application, the question is one of state policy.

In submitting a group solution, in outline, for oral-dental health, finance and service, we are anticipating that organized dentistry will be faced with the necessity of proposing a solution to this problem. We believe a workable system for group oral-dental health service can be devised for the indigent, the underprivileged child and the low income groups without resort to compulsory health insurance; these being the only groups which should receive consideration under any group plan.

SLOGAN

Let organized dentistry adopt a slogan to crystallize its thought as related to any phase or form or coordinated dental service which may be forthcoming. May we suggest: A State Dental Health Agency for Dental Services.

The state dental society should incorporate a dental agency to act for its membership in entering into any arrangement, agreement or contract for group dental service.

THE PLAN

The purpose of the plan is to establish a state dental health consultation, finance and service agency, not for profit, to coordinate and administer oral-dental health services to the following groups: Group 1: The indigent and the underprivileged children, and Group 2: The low income group.

The following income classification is arbitrarily set up for purposes of discussion.

Single persons whose yearly income from all sources is not in excess of $1,200.

Married persons (husband and wife living together) whose total yearly net income from all sources is not in excess of $1,600.

An additional allowance of $400 in yearly net income is allowed for each dependent.

These groups constitute approximately 85 per cent of our total population. ("America's Capacity to Consume.")

The average earnings of all wage earners in 1929 was $1,475. This figure had dropped to $1,199 in 1932 (from the message of the President to Congress on economic security, Jan. 17, 1935).

It is the aim to provide through the agency a flexible state-wide program for conscientious dental health service through private practice:

For Group 1, the indigent and underprivileged child, by agreement or contract with a state or any other agency at a fair fixed cost on terms of mutual agreement with regards to the scope and type of service to be rendered.

For Group 2, the low income group, by individual or group contract based on individual estimate for the services to be rendered of a predetermined scope and financed for the individual by the agency, if necessary, or by any other means which would be determined by any authorized local body, subject to approval by the state agency. Any system providing health service for these groups, such as that used by the Wayne County, Michigan, Plan,[1] The Omaha-Douglas Plan[2] and the Washington, District of Columbia, Central Admitting Bureau Plan,[3] could be administered through this agency.

The dental health agency will have two divisions: the financial service and the professional service. The division is for the purpose of allowing a more efficient management, smoother operation and elimination of confusion of detail.

The function of the financial section is the collection, the allocation and the disbursement of all funds. In outline, the responsibilities of this section are: (1) finance; (2) central office and regional agency management; (3) salaries and compensations; (4) contracts and agreements; (5) records, etc., and (6) social service and investigation.

The function of the professional section, through organized dentistry, is to assure the recipient of conscientious professional services, to assure the state and industrial organizations of an adequate health service and to assure the taxpayer of an efficient expenditure of funds in the case of the indigent and the underprivileged child groups. In outline, the responsibilities of this section are: (1) criteria for fixing policy; (2) professional supervision and audit; (3) uniform policy, procedure and regulation; (4) maintenance of professional standards; (5) definition of scope and service; (6) special services; (7) fee table; (8) consultation, examination, diagnosis; (9) personnel (executives, consultants and designated professional list); (10) health education; (11) compilation of data, and (12) appeal boards.

APPLICATION

By way of explanation, let us trace an applicant for service through the regional dental agency.

Group 1.—Indigent: The scope, care and cost is to be entered into by agreement between the dental agency and the responsible relief agency. The relief recipient, after being certified by the accepted local authorities, will be examined by the dental agency and an estimate returned to the relief agency. On authorization by the relief agency, the recipient will be allowed to go to his own dentist, if the latter is on the designated list, or to choose a dentist from the designated list. After the service is complete, the recipient returns to the dental agency for a professional audit. The dentist is then reimbursed by the agency, the financial section of the dental agency being reimbursed for these professional services by the responsible relief agency. The scope of the professional service can be limited similarly to that now conducted by E. R. A., i. e., to relief of pain

1. Editorial, D. Cosmos, 76:1210 (Nov.) 1934.
2. J.A.D.A., 22:702 (April) 1935.
3. M. Economics, April, 1935.

and elimination of infection with simple restorative measures of such character that, if not cared for, they would become a distinct health liability within two years. Restoration of lost functions will be cared for only when these reach a point where replacement becomes absolutely necessary to health. Any certified recipient will be given an emergency order through the relief agency to a designated dentist for relief of pain or infection, at a fixed fee.

Group 1.—Underprivileged Child: Underprivileged children are to be provided for by a plan operated along lines now employed by the New Jersey Children's Dentistry Project No. S-E3-38, through a grant. The financial arrangements are to be handled through the financial section of the dental agency; the professional scope of service, objectives, aims, organization, etc., to be arranged for and conducted as now in project including reexamination and inspection.

Group 2.—Low Income Group: The applicant would apply at the dental agency, where he must certify as to income classification and investigation, after which the consultant makes the examination, charting in the complete clinical findings and case history. The applicant is then given an estimate on the selected scope of service on the basis of the established fee table. This scope of service could be arbitrarily classified as follows:

Scope 1. Extraction of all infected teeth and teeth with pulpal or near pulpal involvement; also simple amalgam and silicate fillings.

Scope 2. Extraction of all infected teeth and teeth with pulpal involvement; simple amalgam and silicate fillings; vulcanite replacements.

Scope 3. Extractions as before; gold inlays, amalgam and silicate fillings, porcelain inlays, gold and porcelain crowns; root canal therapy; fixed bridges, metal or metal and vulcanite or condensite combination replacements.

All these scopes have as their objective 100 per cent oral health.

After agreeing to the scope and fee, the applicant signs a contract with the financial section of the dental agency based on his ability to pay in the event that he is personally purchasing the service. In the event of applications from industrial or other organizations on a contract basis, the examination and estimate is given on the basis of the contract. The applicant then selects from the designated list the dentist to whom he wishes to go for service. (The dentist has the right to refuse to do the work.) At the completion of the service, the applicant returns to the dental agency for reexamination and a professional audit. The financial section of the dental agency, on approval by the consultant, reimburses the dentist.

The above-described method applies when the consultation and finance agency as advocated by this plan is employed. The state dental agency is so flexible in its organization that if any other method or plan, such as the Washington, D. C. Admitting Bureau, is thought more feasible or workable in any particular locality or community, it still can be administered through the state dental agency.

CONTRACT SERVICE

Any state, lay or industrial agency can enter into a contract with the dental agency to provide dental health service for a group of eligibles. These patients then take the same course as the individuals of Group 2 (low income) except for financial arrangement, which is taken care of by the contracting agency.

Dental service consists of two phases: (1) that of creating 100 per cent oral health and (2) that of maintaining 100 per cent oral health.

SUBSEQUENT SERVICE

Periodic notification will be sent to the patient to reappear for consultation and examination by agreement for the maintenance of dental health.

ORGANIZATION TABLE*

CENTRAL OFFICE

Organized (Year) Incorporated (Year)

THE STATE DENTAL SOCIETY

a component of

THE AMERICAN DENTAL ASSOCIATION

State licensees State membership

DENTAL HEALTH AGENCY, INC.

of

THE STATE DENTAL SOCIETY

CENTRAL OFFICE

BOARD OF DIRECTORS

Vested with the determination of policy, criteria and direction of dental health services.

Eleven members:

Six professional members, one of which is the managing director, one the supervisor of children's dentistry elected by the board of trustees of the state dental society; five lay members, selected by the board of directors.

EXECUTIVE COMMITTEE

Managing Director

Supervisor of Children's Dentistry

Lay Executive

PROFESSIONAL SECTION	FINANCIAL SECTION	PROFESSIONAL SECTION
MANAGING DIRECTOR	INVESTIGATION SECTION	SUPERVISING DIRECTOR
Indigent, Low Income, Inconstitutional } Dental Service	LAY EXECUTIVE	Children's Dentistry Educational Service

REGIONAL OFFICES

REGIONAL SUPERVISOR

(Professional)

Professional Section	Financial Section
CONSULTANT	EXECUTIVE
Designated dentist Private practice	Regional Advisory Committee & Appeal Board:
School dentist Children's dentistry	Three professional, two lay members

LOCAL SERVICES

Designated dentist Designated consultant

*Arbitrarily set up for purposes of discussion.

SUMMARY

The plan outlined would put control where it belongs, within organized dentistry.

There would be no flat rate, per year or per case, but actual remuneration for services rendered.

This plan would not interfere with but would augment private practice, because it would apply only to those groups to whom the profession usually donates their service or from whom they receive but meager compensation.

All work is performed in private offices.

All personnel appointments would remain within control of the profession.

The plan offers simplicity of aim. It will correlate existing dental agencies of many branches of the government and assures prompt payment of authorized professional services.

Commercial insurance companies would be eliminated.

A concrete professional method is provided, upholding accepted health standards without incorporating any visionary insurance plan.

Professional audit by the consultant assures the end result as a health measure.

It provides a definite dental health plan for a group which, under existing conditions, is only spasmodically cared for.

It furnishes opportunity for lay expression through boards of directors, regional advisory committees and appeal boards.

The expense is placed where it rightfully belongs:

(*a*) In the case of the indigent, on the taxpayer.

(*b*) In the low income group, on themselves, on the basis of their own ability to pay, with financial assistance when indicated on investigation.

(*c*) On industrial organizations, employers, institutions or agencies, underwriting in full or in part the cost for employes within the group classification.

This plan would provide a flexible method by limitation of service to meet any expenditure for group dental service.

It would furnish a fixed and fair fee scale acceptable to the profession or any agency for indigent group dental service.

Accurate records would be compiled by a central office.

Standardized forms and methods would be used on service records.

It would provide uniform consultation, examination, estimate and service for the indigent and underprivileged child.

It offers an ideal method of health education dissemination.

This plan would eliminate the much abused industrial, municipal, insurance clinic, and, for other than surgical service, hospital clinics. This does not mean institutional clinics such as penal, mental and sanitarium.

109 North Fifth Street.

OUR MEDICODENTAL PROBLEM

By C. E. Rudolph, D.D.S., Minneapolis, Minn.

The notion that the social change commonly referred to as social medical care comes to a people only as a result of a depression period is not entirely true. In order to understand this, one must take the long-time perspective of social trends. It surely is not necessary at this late date to again call to the attention of the rank and file of dentistry that all the social steps have been taken in the several states which comprise the foundation for some form of social medicine in definite income groups. In other words, we have aged as a people to the point in social development where such trends are developed to a great extent. At the present time, the final legislation in instituting the actual change by

state governments is all there is left to do. This legislative act can be consummated by the political forces in the several states, if they so see fit, either with or without the aid or interference of the professions. These political forces are not always wisely led, especially in complicated social reforms.

It may be interesting to note that a study entitled, "Survey of Statistical Data on Medical Facilities in the United States," by Mr. Allen Peebles, for the committee on the Costs of Medical Care, shows that, in 1927, 70 per cent of all hospital service was rendered by hospitals under government control. You will note that this service was rendered at a time when average incomes in this country were at about the highest peak in our history. Services to the insane and the tuberculous and those having certain other chronic diseases are among those rendered by government hospitals. In my opinion, this fact enhances rather than detracts from the significance of the actual state of affairs in our medical practice. When the World War veteran group demanded more hospitalization during the recent years, we found the private and church organizations, along with the medical professions, protesting. When these hospital groups made a survey of their facilities during this period, they found that they had about a quarter of a million beds not in use. These beds were offered to the government for use in lieu of an expensive building program suggested by the veteran group. The picture in medical care is plain. Depression or no depression, we have a large class of citizens who need medical care badly and who cannot pay the price even when incomes are high, with medical services dispensed as they are in our present system.

In a health insurance plan with proper professional control, these people may get adequate service. Their insurance will at least pay part of their medical expense. Why not lay emphasis on a social set-up which we as dentists can control, if we will? In this way, we can safeguard dentistry's position and standards, and may, in the long run, prevent the wholesale socialization of the medical professions.

The time when each state may institute some such law, of course, cannot be guessed accurately. Suffice it to say that even if the professions are given ten years to get their house in order, it will not prove enough time at the momentum they have reluctantly acquired since first stimulated by medical social unrest. One might think the job of readjustment in the professions belonged to someone entirely extraneous to it, judging from the interest and enthusiasm portrayed by the average man in it.

ALABAMA, KENTUCKY AND NEW JERSEY DENTAL SOCIETIES OPPOSE HEALTH INSURANCE

Alabama Dental Association Resolution

Resolved, That the Alabama Dental Association in convention assembled at Birmingham, are opposed to any form of compulsory insurance dentistry or panel dentistry in this state; and we urge each individual member to contact the representatives from his district in order to perpetuate the advancement of our profession for the protection of the public.

Kentucky State Dental Association Resolution

Resolved, That our association go on record as opposed to sickness and health insurance schemes which require legislative procedure to put into effect.

The Kentucky State Dental Association Economic Committee in the closing paragraph of its report says:

"In closing this report, the committee wishes to go on record as being 'unalterably opposed to any of the plans of health insurance thus far proposed.'

"In the opinion of the committee, the economic situation in this state will not support a program of health insurance satisfactory to the public and adequately remunerate the profession.

"The committee is further of the opinion that Federal and State plans should include adequate dental service for the indigent on a part pay basis in the offices of the private practitioners, leaving all other income groups subject to service on a private practice basis."

RESOLUTION OF THE NEW JERSEY STATE DENTAL ASSOCIATION PASSED IN REGULAR SESSION AT ATLANTIC CITY, FRIDAY, APRIL 26, 1935

WHEREAS, we are confident that the Board of Trustees of the American Dental Association has given ample study and deliberation to the problem of health insurance, and we believe their conclusions and attitude is based on sound and honest conviction, and

WHEREAS, the unanimous decision of this body on the subject of health insurance should be accepted as the nation-wide opinion of organized dentistry, and

WHEREAS, we approve of the dignified and ethical conduct of their procedure in contradistinction to the publicity methods of certain advocates of health insurance, and

WHEREAS, there is an infinitesimal and wilful minority who are not official spokesmen for either the organized medical or dental profession, and this minority is operating as a group of spellbinders and spreading propaganda at every opportunity, and

WHEREAS, these proponents of health insurance admit that as it is practiced in other countries, it is both impracticable and demoralizing, and

WHEREAS, all of their proposals to institute the insurance system in this country are couched in vague generalities, platitudes and indefinite recommendations, and

WHEREAS, the American Dental Association through its Board of Trustees has adopted the following resolution:

"The Board of Trustees of the American Dental Association believes that the enactment of a program of compulsory health insurance administered by the Federal Government, the governments of the individual states, or by any individual industry, community, or similar body, would inevitably lead to the regimentation and lay control of dental practice which would not be in the interest of the public. That a lowering of the standards of dental practice would result, is indicated by the evidence from compulsory health insurance legislation in the European countries where it has been in operation for many years, where it has not only failed to accomplish the measures of alleviation expected of it but also has seriously impeded practitioners of the healing arts in the performance of their duties and has been a barrier to the further scientific development of the professions. The Board of Trustees commends the House of Delegates of the American Medical Association and approves the action pertaining to compulsory health insurance taken at its meeting February 16, 1935"; now therefore be it

Resolved, that the New Jersey State Dental Society approves the action of the American Dental Association and directs that the Board of Trustees of the American Dental Association and all component societies of the New Jersey State Dental Society be so advised.

NEW YORK DENTAL LEGISLATION

The Byrne-Streit Bill sponsored by the Dental Society of the State of New York and its district dental societies, compelling the commercial dental advertiser to abandon commercial advertising, was passed by the New York Senate and Assembly and signed by Governor Lehman, April 17, 1935.

THE QUESTION OF HEALTH INSURANCE PRO AND CON

A very good short article on the question of health insurance pro and con, by R. N. Douglas, appears in the March issue of the *Journal of the Indiana State Dental Association.* The author attempts as briefly as possible to present the position which each side takes in regard to the perplexing health insurance problems.

CURRENT LITERATURE

Principles to Be Observed in the Treatment of Congenital Harelip and Cleft Palate (V. B. Hyslop, Wisconsin M. J., April, 1933): Operative failures in from 70 to 80 per cent of cases indicate that surgical correction of congenital harelip and cleft palate is difficult. In cleft palate, instead of weaning and artificial feedings, Hyslop encourages lactation and gives the breast milk with a Breck feeder. Special nipples to block the palatal fissure are not very satisfactory. Closure of the fissure of the lip by strapping with adhesive tape aids deglutition. The infant should be operated on only when the weight curve is going up, the coagulation time is 3 minutes or less, the hemoglobin is 65+ per cent and no acute infection or untreated persistent thymus is present. The younger the infant, the better the results of operative correction of harelip, the ideal age being the first two or three days after birth. The first operation for palatal closure is done from nine to twelve months after correction of the harelip, regardless of the age at which the lip was corrected. This delay causes narrowing of the fissure. Fundamental facts to be considered in the surgical technic and types of operation on the palate are mentioned, the method of G. V. I. Brown being favored.—Abstr. *Am. J. Dis. Child.,* April, 1935.

Vitamins in Clinical Medicine (S. J. Cowell, Practitioner, January, 1934): From the premise that man has to be taught that his food must contain an adequate supply of essential accessory substances, the author proceeds to a brief description of the chief sources and clinical uses of the vitamins. In connection with vitamin D, he states that cereals actively interfere with the calcification of bones and teeth; hence, the greater the proportion of the diet that is furnished by cereals, the more important it is that a liberal supply of vitamin D be given. The attention of physicians is called to the fact that in certain types of patients and in certain circumstances, it may be of great importance to insure the completeness of diets in all known respects.—*Am. J. Dis. Child.,* April, 1935.

Surgery of the Diabetic (W. E. Leonard, Am. J. Surg., February, 1935): Leonard urges a standardized hospital routine for the care of diabetic patients subjected to surgery with the responsibility vested solely in the surgeon until the surgical period is over. Every patient having diabetes who is operated on should be regarded as a candidate for coma, and its prevention is better than the cure. A high carbohydrate intake for a period of one week before operation should be the rule unless a surgical emergency arises. The carbohydrate intake varies with the individual patient, but, in the author's opinion, should never be less than 150 gm. in twenty-four hours and, if the patient is obese, should be as high as 225 gm. Insulin is used in any amount necessary to control any glycosuria that may arise. When the patient returns from the operating room, he should receive approximately the same amount of insulin in twenty-four hours that he was receiving on his regular diet. Dextrose should be given in amounts equal to his sugar producing intake on his regular diet. Insulin should be given in small repeated doses so that at least 75 gm. of dextrose is metabolized every twenty-four hours in the average patient; in the obese, 150 gm. of dextrose should be metabolized. All urine should be tested for the presence of sugar and diacetic acid. The plasma carbon dioxide combining power is estimated whenever there is any clinical evidence of acidosis. If the acidosis is under control and symptoms of alkalosis occur (prostration and tetany), a close check should be kept of the carbon dioxide capacity of the blood. The slightest acidosis or alkalosis

must be combated vigorously. The healing of operative wounds is somewhat delayed, owing to the peculiar lack of resistance to skin infections even in well controlled cases of diabetes. The healing of chronic ulcers or indolent wounds requires the closest application of surgical technic and control of sugar metabolism. Most patients with diabetes, particularly those requiring surgical procedures, are advanced in years, overweight and suffering from circulatory disturbances and other degenerative lesions, which of themselves make the surgical risk serious.—*J.A.M.A.*, April 27, 1935.

Cigaret Smoking and the Fetal Heart Rate (L. W. Sontag and R. F. Wallace, Am. J. Obstet. & Gynec., January, 1935): Sontag and Wallace made a study of the fetal heart rate, before and after maternal smoking, eighty-one times on five patients. The average fetal heart rate for five minutes before smoking was 144.0±0.14. The average fetal heart rate for the eighth to the twelfth minute after a cigaret was lighted and smoking begun was 149.0±0.13. The average increase in the rate was 5.0±0.19 beats. Since the difference in rates before and after smoking is more than twenty-five times the probable error of the difference, the effect of smoking is actual. Of the five patients, four showed an increase in the fetal heart rate after smoking, while the fifth showed a decrease. The four showing increases were habitual smokers who inhaled the smoke. The patient showing a decrease had never smoked before, did not inhale, and expelled the smoke from her mouth as quickly as possible. There were occasional negative trials in each of the four patients showing an increase. These occurred for the most part at times when the fetal heart rate during the control period was above its average. The increase in the fetal heart rate appears to be due to the passage of the toxic products of tobacco smoke into the fetal circulation, where they affect the fetal heart rate in the same way in which the adult heart rate is affected. Since the toxic effects of tobacco on young children and of nicotine contained in mother's milk on nurslings have been reported, a careful study of the new-born offspring of mothers who smoke heavily during pregnancy is indicated. Evidence of injurious effects of smoking during pregnancy may be overlooked.—*J.A.M.A.*, April 6, 1935.

Effect of Single and Multiple Doses of the Parathyroid Hormone on the Calcification of the Dentin of the Rat Incisor (Isaac Schour, W. R. Tweedy and F. A. McJunkin, Am. J. Path., May, 1934): The effect of single and multiple injections of parathyroid hormone on the incisor of the white rat was studied in twenty-nine animals and seven controls in respect to microscopic alterations and blood calcium changes. The histologic findings are: 1. Enamel hypoplasia formation began immediately after the time of the first injection in five animals. 2. The alveolar bone shows an abnormal increase in osteoclasts in fourteen and a fibrous change of the bone marrow in three of the rats that were given three or more injections of parathyroid hormone. 3. The principal changes are found in the calcification of the dentin. The experimental animals show a primary hypocalcified stripe in the dentin that was being calcified while the immediate effect of the first injection was operative and a secondary hypercalcified stripe in the dentin that was being calcified subsequently. The extent of, and the variations within, the secondary stripe depend on the number and unitage of the hormone preparations injected, and also with the duration of the experiment. It is believed that the experimental pattern in the dentin represents its response to the changes in the calcium and phosphorus metabolism induced by the injection of the parathyroid hormone. The dentin reaction can be explained best on the theory that the parathyroid hormone controls a fraction of the serum calcium. The authors suggest the feasibility of a method of standardization of parathyroid hormone based on the changes shown to occur in the dentin.

T.

Effect of Tooth Injury on Other Teeth. I. Effect of Fracture Confined to One or Two Incisors and Their Investing Tissues upon the Other Incisors of the Rat (Isaac

Schour, Physiol. Zool., July, 1934): The effect of experimental injuries to the lower incisors and their investing tissues upon themselves and distant incisors has been studied in forty-three rats of from 21 to 450 days of age and over a period of from thirty-one to 158 days. The experimental animals were selected at random from the normal rats of four different colonies and over a period of more than two years in order to avoid the possibility of using an abnormal strain. Littermate controls to thirty-four experimental animals were studied, in addition to seventy-three normal animals obtained from similar sources. The rate of eruption was measured, and weekly records of the gross appearance of the teeth and jaws were kept throughout the experiments. A roentgenographic, anatomic and histologic study was made of the teeth after death. The experimental injuries were in the nature of fracturing of one or two lower incisors and their investing tissues. In no case were the upper incisors injured. The control animals showed a normal rate of eruption and a normal roentgenographic and histologic picture of the dental tissues. Those of the experimental animals that were studied before the injuries showed a normal rate of eruption and a normal appearance of the teeth. In 90 per cent of the experimental animals, the result of the injuries were: considerable retardation in eruption and more or less severe histopathologic changes in the dental tissues, particularly the enamel and the enamel epithelium in the injured teeth and in varying degrees in the uninjured teeth as well. The changes were progressive and more or less permanent. In some cases, they appeared within a week after the operations. The following were found not to be the primary factors in the reaction: disturbances in function, in the nervous system, in the endocrines and in the systemic condition. The author states that the only working hypothesis which meets the observations made up to the present time is that the primary factor may be the disintegration of the differentiated dental cells in the injured teeth resulting in a release of specific substances that enter the blood stream and that influence distant homologous cells.

T.

Intra-Oral Cancer and Its Treatment (O. N. Meland, Radiology, March, 1935): A review of the treatment of sixty-nine cases with tongue lesions alone and twenty-six cases with malignancy of the buccal surfaces, palate and alveolar regions is presented. Early routine biopsy in conjunction with smears and blood Wassermann tests in lesions of the mouth refusing to heal after two or more weeks of ordinary treatment is recommended. The author discusses diagnosis and prognosis and states that each case must be treated specifically, for there are no hard and fast rules that can be laid down to cover all cases. From his experience, he does believe that interstitial irradiation for the primary lesion is the therapy of choice, and can be supplemented where indicated with electro-surgery, with highly filtered x-ray irradiation prophylactically and x-ray irridiation for palliative purposes in inoperable groups. A detailed discussion of three cases is used to illustrate the various points and the results of treatment of the groups mentioned above are given.

GRANT VAN HUYSEN.

Median Line Cleft of Lower Lip and Mandible, Cleft Sternum and Absence of Basihyoid (C. B. Morton and H. E. Jordan, Arch. Surg., April, 1935): A case of the extremely rare anomaly, cleft mandible and lower lip, is reported in a female infant. The maxilla, nose and skull were normal above, but the anomaly involved the sternum and the basihyoid. The defect was surgically repaired in two stages and the patient was apparently healthy and normal until nineteen months after the operation, when she died of pneumonia, which followed measles. The regional embryology is discussed with reference to the possible etiology of cleft mandible.

HAMILTON ROBINSON.

Teeth in Fetal Rickets (J. J. Wolfe, Am. J. Dis. Child., April, 1935): The erupted teeth in a proved case of fetal rickets were studied. Gross and microscopic changes characteristic of rickets were seen. Two still-born infants whose mothers had suf-

fered from osteomalacia showed affected teeth also. The authors conclude: Rickets occurring in the fetus manifests itself by gross hypoplasia of the enamel. The changes in the structure of the teeth give information regarding the period of greatest deficiency of calcifying factors. While the bone changes may disappear so that there is no evidence of previous rickets, the changes in the teeth are permanent and remain as indelible evidence of the disease process.

M. K. HINE.

Examination of Saliva (A. Castellani, P. Redaelli, M. Douglas and G. Amalfitano, J. Tropical Dis. & Hyg., April, 1935): An excellent review of the mechanism and nature of salivary secretion is presented. A summation of the properties and composition of saliva is also given with outlines of various tests including Robert's and Wohlgemuth's methods for the estimation of diastatic activity, a method for cellular examination and a test for the demonstration of gelatinase. A method for clinical examination of saliva is presented which embraces tests for phophates, chlorides, thiocyanic acid and estimation of enzymes, cells and mucous deposits. Comparison of salivas in various diseases is recorded. An excess of mucus was observed in sprue and pernicious anemia. No significant changes appeared in cases of encephalitis lethargica, duodenal ulcer, chronic bronchitis and colitis.

B. G. BIBBY.

Treatment of Salivary Fistula by Irradiation (U. V. Portmann, Ann. Surg., May, 1935): Salivary fistulas may be relieved by temporary suppression of glandular secretion through irradiation. Submaxillary or sublingual gland fistulas seldom require treatment, usually healing spontaneously. Parotid fistulas are, as a rule, obstinate and few show spontaneous closure. Sutures are not effective in these parotid fistulas, often acting as foreign bodies and actually causing fistula formation. It was found that strong doses of radiation interfered with the function of the salivary glands and diminished their secretory activity. Microscopically, the resulting picture is one showing the usual signs of degeneration. Case histories are presented for three patients treated by irradiation together with the technic employed. The function of the gland may be resumed in about four months.

HAMILTON ROBINSON.

FOREIGN LITERATURE

Factors Other Than Anesthetics Affecting Anesthesia (H. P. Crampton, Proc. Royal Soc. Med., November, 1934): Drugs, route and apparatus employed are not the only factors in anesthesia. The patient's mentality, physique, habits and certain pathologic conditions, such as status lymphaticus, myocardial degenerations and emboli, must be considered. The anesthetist himself, as regards stage management, judgment and personality, is a factor. The surgeon and the operation are also of importance. The author points out the various influences of these factors and uses interesting cases in illustration.

HAMILTON ROBINSON.

Evapin in Dental Anesthesia (R. R. MacIntosh, Proc. Roy. Soc. Med., January, 1935): In patients of two types, the robust (often alcoholic) individual and the individual with extreme fear of inhalation anesthesia, evapin has proven most valuable, chiefly in preanesthesia. In 1,000 cases, patients have rarely become quarrelsome, but occasionally hysterical. Evapin is indicated for cases of anesthetic, not operative, difficulty. Pernocton is preferable for major operations. Considerable experience is necessary for successful administration of evapin.

HAMILTON ROBINSON.

Abnormal Sutures of Palatal Vault (A. Zona, Stomatologia, March, 1935): The author studied 1,165 craniums belonging to the Institute of Criminal Anthropology of Naples. He classifies and describes the various congenital anomalies seen by him. The types of sutures discussed are as follows: (1) incisive sutures; (2) Turner's cuspid-bicuspid; (3) torus palatinus; (4) small supernumerary bones of palate; (5) longitudinal sutures; (6) intermediate longitudinal sutures; (7) lateral longitudinal sutures. Fourteen of the craniums ex-

amined are known to have belonged to criminals. The article ends with an extensive table organizing the material discussed.

Radicular Cysts on Healthy Teeth in Children (P. Jacques, Rev. Stomatol., March, 1935): The author mentions various theories as to the origin of radicular cysts, paying particular attention to the hypothesis that irritation is essential to give rise to a cyst. Ardoin, in 1933, said, "A certain degree of inflammation is necessary"; while Lenormont said that "one never observes a cyst in connection with a healthy tooth." The author himself believed that a slow form of irritation or inflammation was necessary. In the past year, he had observed two cases in children, 10 years of age, on live and healthy teeth. The question of a hematogenic infection was raised, but he wondered why bacteria in circulation would colonize around a healthy tooth. The bacteriologic study has shown that the walls and the contents of the tumors were sterile. A slight and recurrent trauma might have been present, but it could not be demonstrated. The possibility of a familial tendency or a "cystic diathesis" was considered. Very slight accidents can give rise to cystic processes in such persons. In the two cases reported, there was a suspicion of hereditary syphilis, which might be held responsible. Whatever the pathogenetic mechanism might be, the author concludes that the absence of caries and of signs of pulpal mortification does not exclude the diagnosis of radicular cysts in young persons.

Caries of the First Molar in School Children (Lino Bubani, Pediat. d. M. Prat., September, 1934): The author examined 1,245 school children between the ages of 6 and 12 in an Italian city (Biella). He found caries in 93.36 per cent of the children. The first molar is the earliest and most frequently involved tooth of the permanent dentition (26.03 per cent). He mentions the various etiologic factors in caries (lack of oral hygiene, heredity, dystrophies, vitamin deficiencies, etc.). He points out the necessity of early treatment, with the need of preserving the teeth kept uppermost in mind. Constant supervision of the secondary teeth should be maintained by school or public health officials. Hygienic procedures should be taught the children and supervised by the teachers. Prevention of dental caries should go as far back as to include prenatal care of the mother to avoid the appearance of dystrophies and deficiency diseases in children.

Oral Infection with Lymphogranuloma Inguinale (R. Bezecny and F. Sagher, Med. Klin., March 1, 1935): Bezecny and Sagher relate the history of a man, aged 46, who four weeks previous to obtaining medical aid developed an ulceration of the tongue and a week later a swelling of the lymph nodes of the left side of the neck. The primary lesion and the involvement of the regional lymph nodes made a syphilitic infection likely, but the tests for syphilis gave negative results, while the Frei test was positive. The anamnesis disclosed that the patient had had intercourse with a woman who four years before had a disorder of the inguinal lymph nodes. It appears that a bubo had developed, had become soft and was incised. The localization of the lesion in the man corresponded to the anamnesic statements about the type of intercourse. In the conclusion, the author emphasizes that caution is necessary in declaring a patient with lymphogranuloma inguinale cured, for in this instance the woman was apparently cured, and she again became a source of infection four years later.—*J.A.M.A.*, April 27, 1935.

NEWS

CALIFORNIA

Bill Introduced: A. 2401 proposes to regulate the conduct of pounds and to regulate the disposition of animals impounded or sheltered therein. This bill specifically makes it unlawful for any pound master to permit any live animal in his custody to be used for experimental purposes or to turn over any animal in his custody to any person, school, university research laboratory or experimental station to be used for educational demonstration or medical, scientific or experimental purposes.

COLORADO

Bill Introduced: H. 634 proposes to require all applicants for licenses to practice any form of the healing art, before presenting themselves to their respective professional boards for examination, to pass examinations in anatomy, physiology, chemistry, bacteriology and pathology, to be given by an impartial board of examiners in the basic sciences. The members of the board of examiners in the basic sciences are to be selected because of their knowledge of these sciences and each member is to be on the faculty of the University of Colorado, the Colorado State Agricultural College, the Colorado School of Mines or some other institution of learning in the state of equal rank. No member of the board is to be engaged in the practice of the healing art during his term of membership.

Narcotic Drug Law Enacted: Two bills, which were approved by Governor Johnson, March 16, and which were to become effective immediately, are of considerable interest. One of them (H. 557) prohibits the retail sale, except on the written prescription of a licensed physician, dentist or veterinarian, of barbital, sulphonethylmethane (trional), sulphonmethane (sulphonal), diethylsulphon diethylmethane (tetronal), paraldehyde and chloral or chloral hydrate or any derivatives, compounds or mixtures of any of these drugs possessing hypnotic properties or effects. The other (H. 138) is the uniform narcotic act, drafted by the Conference of Commissioners on Uniform State Laws with the aid of the Bureau of Legal Medicine and Legislation of the American Medical Association and the American Bar Association. The term "narcotic drug," as used in this law, includes cocoa leaves, opium, cannabis and every substance neither chemically nor physically distinguishable from them. A physician or a dentist, acting in good faith and in the course of his professional practice only, may prescribe, administer and dispense narcotic drugs, or he may cause them to be administered by a nurse or intern under his direction and supervision. Physicians and dentists are to keep a record of such narcotic drugs received by them and a record of all such drugs administered, dispensed or professionally used by them otherwise than by prescription. Uniform narcotic drug acts have been enacted in about fifteen other states.

ILLINOIS

Bill Introduced: H. 672 proposes to prohibit the retail sale or distribution of veronal, barbital or any of their salts, derivatives or compounds except on the prescription of a licensed physician, dentist or veterinarian.

Capps Prize Awarded to Dr. Gulbrandsen: The Institute of Medicine of Chicago has awarded the Joseph A. Capps Prize for 1934 to Lars F. Gulbrandsen, instructor in pathology, bacteriology and public health, University of Illinois College of Medicine, for a paper on "Invasion of the Body Tissues by Orally Ingested Bacteria and the Defensive Mechanism of the Gastro-Intestinal Tract." The prize of $500, established by an anonymous donor in honor of Joseph A. Capps, is awarded annually for the most meritorious medical

research by a graduate of a medical school in Chicago completed within two years after graduation.

Bill Introduced: S. 257 proposes to require all persons licensed to practice any form of the healing art to register annually with the director of registration and education and to pay an annual renewal fee of $1.

INDIANA

Junior A.D.A. Association: The Indiana chapter of the Junior American Dental Association held a meeting, April 9, at which Dean Henshaw spoke to the members on "The History and Growth of Indiana University Dental School." Another feature of the program was a review by one of the association members, William Hammersly, of an article on "Hypersensitive Dentin," appearing in the April issue of THE JOURNAL.

First Dental Intern Appointed: The first dental intern in Indiana has recently been appointed for the Methodist Hospital, Indianapolis. Donald Draper, a senior dental student at the Indiana University Dental School, will assume his new duties, July 1, along with the newly appointed medical interns.

IOWA

Bill Enacted: S. 20 has become a law, requiring all applicants for licenses to practice any form of the healing art as a condition precedent to their right to examination by their respective professional boards, to pass examinations in anatomy, physiology, chemistry, pathology, bacteriology and hygiene, to be given by an impartial basic science board.

LOUISIANA

New Dental Building Planned: Bids will be opened this month for construction in New Orleans by Louisiana State University of a fifteen story dental and pharmacy school building, as a part of the medical center expansion program at the institution. Planned for occupancy next fall, the new building will be erected on the grounds of Charity Hospital at a cost of $2,500,000. It will be equipped with classrooms and laboratories for the teaching of dentistry, pharmacy, medicine and surgery. The expansion program will also include the rehabilitation of the hospital at a cost of $8,000,000, it was stated.

MARYLAND

Bill Passed: H. 145 has passed the house and the senate, proposing to prohibit the retail sale and distribution of barbital and other hypnotic and somnifacient drugs except on the prescription of a licensed physician, dentist or veterinarian. The drugs mentioned are to include barbituric acid, sulphonethylmethane (trional), sulphonmethane (sulphonal), diethylsulphon diethylmethane (tetronal), paraldehyde and chloral or chloral hydrate or chlorbutanol.

MASSACHUSETTS

William Rice Memorial Plaque: Last year the Tufts Dental Alumni Association presented the School with a portrait of the late William Rice, dean of Tufts College Dental School from 1916 to 1932, in testimony to his vision and leadership. March 27, 1935, the classes of 1934 to 1937, inclusive, dedicated a bronze plaque to further perpetuate the memory of the late dean and to serve as witness to their appreciation of his ideals for the advancement of both the school and the profession.

MINNESOTA

Resolution on Dental Journalism: The following resolution presented by the publication committee was unanimously adopted by the House of Delegates of the Minnesota State Dental Association, February 26:

WHEREAS, it is the concern of the Minnesota State Dental Association to maintain the status of dentistry as one of the learned professions and to raise its professional and scientific standards as high as is possible; and

WHEREAS, the relationship of the dental manufacturers and dental dealers to the dental profession with respect to the publication of dental magazines and the management and supervision of postgraduate courses for dentists is unparalleled in other

learned professions, a relationship which affects adversely the standing of dentistry in the scientific and professional world; and

WHEREAS, there exists in the dental profession in this country a growing sentiment in favor of a more complete separation from the commercial interests, which sentiment is shown by the action of many of the strongest boards and dental society groups in the United States deploring the condition that now exists; and

WHEREAS, dental journalism should be a function of scientific or professional groups and dental education should be a function of university dental schools or recognized dental societies; therefore, be it

Resolved, that the Minnesota State Dental Association request the officers and Board of Trustees of the American Dental Association to further the aims and ideals set up in the ever increasing demand of its members for the elevation of dental journalism to a dignified and professional basis, owned and controlled within and by the profession; and, further, that in the transition of dental journalism from the trade-house dental journals to strictly nonproprietary dental journals, we request our own members to cease contributing articles for publication in proprietary journals, acting on the editorial staffs of such journals and subscribing for issues of such journals.

House File 210: The Legislative Committee, with the assistance of many members of the state dental association, successfully worked for the passage of House File 210, the new dental act. It is an act with enforceable provisions and one which protects the public and the profession. It was passed practically intact. The only amendment being added was that offered by the editorial association.

Co-operative Advertising: Twenty years ago the American Medical Association instituted the Co-operative Medical Advertising Bureau among twenty-one state medical publications. Today the American Association of Dental Editors is sponsoring a similar movement for nonproprietary dental journals. Among other recommendations made by the sponsors of the movement is an agreement to accept no pharmaceutical advertisements except those approved by the A.D.A. Council on Dental Therapeutics; a certain type of paper and cover to be used and certain advertising rate adjustments to be made to facilitate the plan.—*Northwest Dentistry.*

NEW YORK

The New York Journal of Dentistry Appoints New Editor: Increasing demands on the time of the previous editor of the *New York Journal of Dentistry* has made it necessary for him to relinquish his office. Bissell B. Palmer was elected editor at the annual meeting of the First District Dental Society, April 1.

Society of Dentists of Health Department: The Society of Dentists of the Department of Health, the purpose of which is to promote better dentistry and elevate social and economic standards, has elected the following officers: president, Harvey L. Gottesman; vice president, Mark Vloch; treasurer, Francis Hirsch, and secretary, Samuel Menn.

Secretary of Milbank Fund Resigns: John A. Kingsbury, secretary of the Milbank Memorial Fund, New York City, since 1922, has resigned because of "differences of opinion as to policy," according to an announcement made by the board of directors after their annual meeting, April 19.

OHIO

Increase in Membership: Since October, 1934, 113 new members have been taken into the Cleveland Dental Society.

Amendments to Dental Law Signed by Governor: House Bill No. 145 (the amendments to the Ohio Dental Law) passed the Senate without a dissenting vote and was signed by the governor, April 11. The overwhelming vote cast in favor of this bill in both branches of the legislature would ordinarily indicate that little or no opposition was encountered. Such was not the case in this instance. A concerted effort was made by opponents of the bill "to tack" on certain amendments which, had they been included, would have defeated the

original purpose of the bill. For example, one amendment, introduced by Senator Waldvogel of Cincinnati, would have rendered null the section preventing a dentist from operating a chain of offices. Another amendment, introduced on the senate floor, would have exempted newspaper advertising from the limitations which the original bill imposed. Both of these amendments and all other efforts to kill the bill were frustrated. As the bill now stands, the state dental board is given the right to safeguard the people of Ohio from the unscrupulous practices of the charlatan and the quack.

Diagnostic Service: The Diagnostic Service of the Cleveland Dental Society began April 10. It is a program of dental health education among employed persons in their places of employment, under the sponsorship of the society, and with the cooperation of the employers. Its principal elements consist of: 1. A fifteen or twenty minute introductory dental health talk to all employes in a group. 2. Complete dental roentgenograms of each employe. 3. Distribution of dental health literature. 4. Clinical examination of each employe by a dentist. 5. Reference of each employe to his own dentist for treatment. 6. Subsequent reexamination after six months.

OKLAHOMA

New Dental Law: One of the features of the new dental law recently enacted by Oklahoma is the provision for the qualification of specialists. The law states, "No member hereof (dentist) shall announce and/or hold himself out to the public as limiting his practice to, or as being especially qualified in, any branch of dentistry, without having first obtained a license therefor from the Board as hereinafter provided." The law gives the Board power to appoint special examiners, and may require both written examinations and practical demonstrations of the applicant's skill. The National Board of Examiners is recognized, and graduated punishment is provided for violation of the act. Among other things, the law states that the Board shall have power to revoke the license of a member hereof or suspend a member from practice or reprove said member upon the following grounds: . . . false, fraudulent or misleading advertising; permitting, directly or indirectly, an unregistered or unlicensed person to practice dentistry or dental hygiene under his direction; permitting any dental hygienist to perform any operation other than permitted herein; dishonorable or unprofessional conduct; holding himself out as especially qualified in or limiting his practice to a branch of dentistry, without any of the provisions of the act. The law further provides: "Any person who shall practice, or attempt to practice, dentistry, or dental hygiene, within the State of Oklahoma after his license shall have been revoked, as herein provided, or without having complied with the provisions of this Act, shall be guilty of a felony." The annual membership fee may vary from $2 to $5 at the discretion of the board and the power of injunction is specifically given to the board.

Bill Introduced: S. 285 proposes to require all applicants for licenses to practice any form of the healing art, as a condition precedent to their right to examination by their respective professional boards, to pass examinations in anatomy, physiology, chemistry, bacteriology and pathology, to be given by a board of examiners in the basic sciences. This board is to consist of five members, members of the faculty of the state university, the state agricultural college, or some other state institution of learning in the state learned in the basic sciences and not engaged in the practice of the healing art.

OREGON

Pharmacy Act: The *Journal of the American Medical Association,* March 9, commented on the provision of the Oregon pharmacy practice act, approved February 21 (Laws, 1935, ch. 55), that nothing in it should be construed to prevent the personal administration of drugs and medicines carried by physicians, dentists or veterinarians, "to supply the immediate needs of their patients." The chairman of the legislative committee of the Oregon State Pharma-

ceutical Association calls attention to another provision that nothing in the act shall interfere with licensed physicians and dentists supplying their own patients with such remedies as they may desire, provided the physician or dentist does not keep a pharmacy or drug store. The provision authorizing practitioners of medicine or dentistry to supply remedies to their patients will presumably be construed to supplement and broaden the provision that limits physicians and dentists to the personal administration of drugs and medicines carried by them.

PENNSYLVANIA

Sickness Insurance Bill Introduced: H. 1959 proposes a system of compulsory and voluntary sickness insurance. The benefits proposed are to consist of cash and all forms of medical and dental service. Persons employed at "other than manual labor" and receiving wages in excess of $60 a week, farm laborers and persons employed by an employer having less than three employes in personal or domestic service are excluded from the compulsory insurance of the bill but are entitled to participate in the voluntary insurance.

SOUTHERN CALIFORNIA

Food and Drug Act Indorsed: The Southern California State Dental Association, April 20, passed a resolution favoring the passage of the Food and Drugs bill now before Congress and suggesting that a committee be appointed to further the interests of the bill.

TENNESSEE

Membership: For the first time in the history of the Tennessee State Dental Association, 558 members had paid up by March 1. Membership in three districts is 100 per cent. Forty-two members were still needed that the objective of the membership chairman, 600 members by May 15, might be realized.

TEXAS

Largest Mottled Enamel Area: A survey recently completed by the U. S. Public Health Service and the Texas State Department of Health offers evidence that the Panhandle-West Texas district is the largest mottled enamel area in the United States. A less exhaustive study in the east central part of the state revealed another endemic area, the extent of which was not determined. Fifty-three communities in thirty-seven counties in the western area were surveyed by examination of the teeth of school children, usually of the fourth, fifth and sixth grades. A history of the water supply used was taken and the degree of severity of the condition noted in accordance with a classification previously worked out, varying from "questionable" to "severe." Communities were classified according to the percentage of each degree of severity. Only children who had been born in the community and had always used the municipal water supply were counted in the determination of the community's mottled enamel index. Samples of the water supply were taken and were being examined for fluorides in the laboratories of the state health department at the time of the report (*Public Health Reports,* March 29, p. 424). Of the fifty-three towns surveyed in West Texas, in Lubbock, a town of 20,000, the teeth of all the children examined (176) showed mottled enamel; in Plainview seventy-six out of seventy-eight showed it in some degree; in Amarillo, the largest city of the area, only five out of 168 children had normal teeth. The fact that the water supplies of such large towns contain the causative factor in sufficient concentration to produce such a high incidence of mottled enamel has developed an acute public health problem, the investigators concluded. In the east central area, only thirteen communities were surveyed, but of these two were classified as "borderline" and none as "negative."—*J.A.M.A.,* April 27, 1935.

VIRGINIA

Medical College of Virginia Ninety-Seventh Commencement: At the Ninety-Seventh Commencement of the Medical College of Virginia, May 28, the honorary degree of doctor of science was conferred upon Charles R. Turner, dean, University

of Pennsylvania, School of Dentistry, Philadelphia. Dr. Turner is an alumnus of the School of Medicine, Medical College of Virginia. There were seventeen graduates in dentistry.

FOREIGN

Dental Surgeons of Damascus Elect Officers: The Association of Dental Surgeons of Damascus, at a general meeting, elected the following officers for the year 1935: president, Najat I. Safady; vice president, Seifidin Tabbakh; general secretary, Chafik Chehade; treasurer, Said F. Imam; assistant secretary, Salim Kassatly.

Charles Mickle Fellowship for 1935: Professor Edward Mellanby and Mrs. May Mellanby have been jointly awarded the Charles Mickle Fellowship for 1935 by the University of Toronto. The fellowship is awarded to that member of the medical profession who has done most to advance a sound knowledge of a practical kind in medical art or science during the preceding ten years. While Mrs. Mellanby is not, in the usual sense, a member of the medical profession, her publications are sufficiently well known to them. Professor Edward Mellanby's distinguished research in the fields of physiology, pharmacology and medicine have long earned him a world-wide reputation.—*D. Rec.,* April, 1935.

Sir Alfred Levy New President of Clinic: Sir Alfred Levy has become president of the Eastman Dental Clinic, Royal Free Hospital, thus filling the vacancy left by the death of the late Lord Riddell. His former position as chairman has been taken by Sir Percy Everett.—*D. Rec.,* April, 1935.

Saliva and Immunity to Diphtheria: The explanation given by Behring a number of years ago for diphtheria immunity (presence of a sufficiently large amount of antitoxin in the blood) does not hold good, as Professor Dodd, hygienist of Tübingen, has pointed out, in the face of the fact that there are animals which, in spite of marked parenteral (subepithelial) sensitiveness to diphtheria bacilli and their poison, and in spite of the absence of demonstrable quantities of diphtheria antitoxin in the blood, do not spontaneously contract pharyngeal or nasal diphtheria; nor can they be made to develop diphtheria by a massive experimental infection of the pharyngeal and nasal mucous membranes with virulent and toxic diphtheria bacilli. It is evident, therefore, that in these cases other protective mechanisms must be present. Of these, the protective action of the saliva and of the nasal secretion is doubtless the most important. Likewise the saliva of human beings (of adults and of the older school children) possesses such protective mechanisms capable of combating toxic diphtheria bacilli. It may serve to check their development; it may kill them after they have developed, or (in the event of long continued action) it may transform them into diphtheroids or into pseudo diphtheria bacilli, whereas the diphtheria toxin is not made inactive by human saliva. In establishing immunity to diphtheria and in connection with its origin and spread, this action of the saliva (presence or absence of these protective mechanisms) must be at least of equal importance with the antitoxin content of the blood; for, ahead of the antitoxic immunity of the blood, which constitutes, as it were, the second and last reserve force, the first line of defense is formed by the saliva or the nasal secretion, with the described antibacterial protective mechanisms. The therapeutic value of the antitoxin serum is, of course, in no wise affected by these observations.—*J.A.M.A.,* April 13, 1935.

German Roentgen Society: Until recently, Germany had a considerable number of roentgenologic societies, some of which had scientific and some economic aims. It has now been ordered that the "Deutsche Röntgen-Gesellschaft" shall be the only roentgenologic society in Germany. All other societies in this field have been dissolved.

Dental Health in Honolulu: The year 1934 stands out as an important milestone on the road to dental health in Honolulu. According to the report of the Palama Settlement Dental Clinic for School Children, in November, 1920, the first patient was registered in the original Honolulu Dental Infirmary, and, December 31, 1934, patient

number 29,005 was admitted for treatment. The widespread influence on the community's health can easily be imagined when it is realized that the number of patients cared for during the thirteen years of operation approximates the entire population of the city of forty years ago. The past year has shown a decided improvement in the amount and quality of work performed. The number of fillings in permanent teeth were increased by 6,755 and fillings in deciduous teeth were 2,272 more than for 1933. Extractions averaged 1.6 per child against 2.1 in 1933, a decrease of 0.5 per individual for the year, and a reduction of 0.8 per child from the 1932 figure. Treatment increased 2,469 and averaged 0.7 per child against 0.5 in 1933. This classification is confined to the topical application of medicaments for the relief of pain and the treatment of infections.

Incorporation of the South African Dental Association: The chief item on the Agenda was the subject of incorporation of the Association, the principle of which has now been approved and which, it is hoped, will result in the unification and organization of the entire South African profession. Under incorporation there will be no change in the local autonomy of branches, but the Association will have complete jurisdiction over members, and all liability will be limited. There will be the further advantage that in the eyes of the people and of public bodies the Association will have legal standing. Application for incorporation has now been made and should be an accomplished fact within the next few months. The Council of the Association has agreed that as soon as incorporation is accomplished application be made for affiliation to the British Dental Association. Probably 75 per cent of South African dentists received their dental education in Britain and it is therefore surprising to find that less than twenty are ordinary members of the British Dental Association. Affiliation between the S.A.D.A. and B.D.A. will to some extent rectify this position and will in any case be warmly welcomed by all South African dentists.—*D. Mag. & Oral Top.*, April, 1935.

Ontario Government to Discontinue Dental Grants? According to the estimates recently tabled in the Provincial House, the dental grants to municipalities have not been provided for in this year's budget. These grants were given to municipalities to assist in maintaining dental clinics for boys and girls whose parents could not afford to pay dental fees. If these grants are now stopped, the clinics in some of the smaller communities will probably be discontinued, as it was only with the assurance of this grant that a number of these services were started. The result will be that the poor children will suffer. In 1934, slightly more than $10,000 was paid by the Ontario Government to various municipalities as a grant to assist in maintaining these dental clinics. A comparison of the public accounts figures for the year ending Oct. 31, 1934, and the estimates for dental services for the fiscal year ending March 31, 1936, shows a decrease of $14,249.89. This is chiefly accounted for by discontinuing grants to municipalities and by elimination of the dental division under a paid director and re-establishing it under a new director without salary. The elimination of dental grants is a serious mistake in the opinion of the writer, as the amount involved is only approximately $10,000, while the benefits to the municipalities can scarcely be computed. Dental relief provides only for extraction, and then only for people actually on relief, consequently dental relief cannot, in any way, replace the dental clinics. Is not the saving of these children's teeth and health worth $10,000 to this Province? The Public Dental Health Committee has called the attention of the proper authorities to this change in the budget, and is doing all in its power to have these grants continued.—*J. Ontario D. A.*, April, 1935.

Deaths

Broadway, Charles H., Chicago, Ill.; died April 22; aged 62.

Punton, Alfred Louis, Overland Park, Kans.; State University of Iowa, College of Dentistry, 1888; died March 8; aged 75.

Simpson, O. H., Dodge City, Kan.; Ohio College of Dental Surgery, 1884; died April 1; aged 74.

Thompson, Orrin, Neenah, Wis.; Chicago College of Dental Surgery; died April 29; aged 66.

Todd, William L., Linton, Ind.; Indiana University School of Dentistry, 1900; died March 26.

Mason, Walter L., Red Bank, N. J.; died April 14; aged 80. Dr. Mason was the inventor of the Mason detachable facing for crowns and bridgework and the detachable tooth.

MISCELLANY

BOOK REVIEW

A Textbook of Biochemistry. Edited by Benjamin Harrow, Ph.D., Associate Professor of Chemistry, The City College, College of the City of New York, and Carl P. Sherwin, M.D., Sc.D., Dr. P.H., LL.D., Member of the Staff of St. Vincent's Hospital and French Hospital, New York City. 797 pages; 52 illustrations. Philadelphia and London: W. B. Saunders Company, 1935. Cloth, $6 net.

A textbook of nearly 800 pages on the subject of biochemistry must of necessity have much in it of interest to dentists. In fact, a slight addition might logically have been made to the preface where it says: "The text, which has been planned for teachers and students of medicine, chemistry and allied branches," etc. Dentistry should definitely have been included in its purview. Surely in all conscience, during recent years, the literature of dentistry has contained sufficient material on the subject of nutrition and diet to justify its inclusion in a textbook of this character, and logically enough, when we go to the body of the book, we find that much consideration has been given this subject.

The authors have gathered around them no fewer than thirty contributors, which in itself speaks eloquently for the comprehensive character of the volume. Naturally, the chapters that must appeal most to dentists are found in a study of those processes that deal with diet as it affects the bones and teeth, and, in particular, the relationship between nutrition and tooth decay. The statement is made that, "In recent years, there has been an increasing interest among nutritional investigators in the relation of the diet to tooth decay." This would seem to be a very appropriate study in connection with the biochemical phase of the subject, and it is no reflection on the up-to-date character of the book to be forced to realize the fact that, after reading this chapter, there is found in it little of a really significant or conclusive character. This cannot be said to be the fault of the book or of the chapter, but is merely an expression of the prevalent lack of finality in the current comment of the day on this topic.

After the most laudable efforts that have been made in our recent literature to throw light on this subject, the conviction is being forced on us that the study of nutrition and diet is not the whole story to the question of dental decay. Not that we should minimize the great importance of nutrition, but that there are other agencies that enter into this problem. No one should be permitted to think lightly of the question of diet when, for instance, the statement is made that: "Pellagra is a national health problem in the United States and a few other places," and "approximately 200,000 persons are now suffering from the disease in this country because of inadequate diet."

Probably the word "vitamin" has been used with greater frequency and less understanding than any other in our literature, and the chapter on this subject in the present volume will yield much needed information. It is a subject that cries for further study and a simpler elucidation before the average medical and dental mind can fully grasp it, and this is all the more apparent when we read the statement that

"Today, no less than nine vitamins are recognized, and the existence of others is suspected." Other studies of interest to dentists are found in such topics as "Detoxication," "Enzymes" and "Hormones," terms that appear in growing frequency in our periodic literature, and that call for further study on the part of every dental practitioner.

To analyze in detail all of the various agencies at work in a consideration of the biochemistry of the human organism is, of course, quite out of the question in the limits of a brief review of this character, and for a further consideration of this important and fascinating subject, the reader is referred to the book itself. It will repay the time and effort spent on it.

CORRESPONDENCE

"Current Literature"

To the Editor: I wish to express my appreciation of the current literature section in The Journal. It is impossible for any one investigator and teacher to keep up with the literature even in the fields that are closely related to his subject of interest. The day is too short and one never knows in which journal the most recent report on the subject matter of one's special interest may be found. In going over your abstract section, I have found some valuable references that I would have missed otherwise. For example, in the March issue, there is an abstract of a current work on the effect of vitamin C deficiency on tooth structure by Fish and Harris of England. This report is an important contribution to a subject which I am investigating at the present time. Having read the abstract and reference, I was able to go back to the original article and read it in greater detail. I could mention other instances in which your abstracts gave me the first information available in current issues of journals which I am unable to read regularly.

A few days ago I happened to discuss osteitis fibrosa with a dentist, who was specially interested in this condition. He referred to an abstract on this subject published in the April issue.

It occurred to me that you might be interested to learn of the profitable use of this section of The Journal.

Isaac Schour.

NEW RESEARCH ON NUTRITION AT MELLON INSTITUTE

During 1934, Gerald J. Cox and Miss Mary L. Dodds, working on a fellowship at Mellon Institute of Industrial Research, conducted certain studies of the fundamental causes of tooth decay and, in consequence of their investigational findings, Dr. Cox and Miss Dodds have pointed out that there is thereby suggested the existence of a factor which, if present in the diet during a critical period of tooth formation, will aid in the construction of teeth resistant to decay. It is now announced by E. R. Weidlein, director of Mellon Institute, that this research is to be continued, along broad lines, through a grant for a period of one year from the Buhl Foundation, of Pittsburgh. The investigation, which will be known as the institute's multiple fellowship on nutrition, will be carried on by Dr. Cox as senior fellow, Miss Dodds as the junior incumbent and W. E. Walker as the assistant, in the Department of Research in Pure Chemistry of the institution. This new fellowship will have the advisory aid of L. H. Cretcher, the departmental head, and of the biochemical, food and nutritional specialists on the institute's staff.

The experimentation was resumed under this group on April 15, and it is planned first to determine definitely whether or not the factor referred to actually exists, and, if so, all about its nature, properties, distribution and extraction. Secondly, studies will be made of physiologic processes which are likely to influence the development of dental caries. It is the intention to publish the results of these researches just as soon as positive conclusions are reached.

In their preliminary studies during the past year, Dr. Cox and Miss Dodds observed a new type of experimental dental caries in rats that seems to be related to the diet of the animal, that is, of the nursing mother at the time of the formation of the enamel in the young. The appear-

ance and location of the initial lesions indicate that the decay was not caused by fracture arising from coarse particles of food. As the lesions first appeared as opaque areas and later became open cavities, they were described as closely resembling typical enamel caries in the human subject. It was therefore concluded that they probably arise by the same process in both species. As susceptibility to tooth decay in the rat appeared to be related to the diet during tooth formation, Dr. Cox and Miss Dodds made modifications of the maternal diet to determine whether the incidence of caries could be controlled; and they found that caries appeared on diets made up with all the presently recognized essential constituents, although, when such diets were supplemented with certain milk fractions, or with milk itself, they observed that the incidence of caries was markedly reduced. These experimental results, which as mentioned, suggest the existence of a factor in food which plays a part in the formation of decay-resistant teeth, were recently summarized in Dr. Weidlein's twenty-second annual report to the Trustees of Mellon Institute.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, New Orleans, La., November 4-8.

American Academy of Periodontology, New Orleans, October 31-November 2.

American Society of Oral Surgeons and Exodontists, New Orleans, November 1-2.

American Dental Society of Europe, London, July 31-August 3.

Belgian National Dental Congress, Brussels, August 1-4.

Dental Alumni Association, American University of Beirut, Beirut, Lebanon, June.

Dental Society of State of New York, Upper Saranac, June 12-15.

Greater New York December Meeting, New York City, December 2-6.

International Dental Congress, Vienna, Aug. 2-9, 1936.

International Dental Federation, Brussels, Belgium, August 4-10.

Montreal Dental Club Fall Clinic, October 17-19.

New York State Dental Hygienists Association, Saranac, June 12-15.

Northern Ohio Dental Association, Cedar Point on Lake Erie, June 17-18.

Philadelphia Dental College and Dental School, Temple University Alumni Society, Philadelphia, June 11-12.

Alumni Association of Texas Dental College, Houston, June 10-12.

American Dental Assistants Association, New Orleans, November 4-8.

American Dental Hygienists' Association, New Orleans, November 4-8.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

June

Colorado, at Estes Park (24-26)

Maine, at Augusta (21-22)

New Hampshire, at Rye Beach (26-27)

New York, at Upper Saranac Lake (12-15)

North Carolina, at Blowing Rock (17-19)

Oregon, at Portland (5-8)

July

Southern California, at Long Beach (8-12)

Virginia, at Hot Springs (1-3)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 24. E. W. Patton, 1807 Comer Bldg., Birmingham, Secretary.

Arizona, at Flagstaff, July 1. R. A. McCall, 719 Professional Bldg., Phoenix, Secretary.

Arkansas, at Little Rock, June 17-20. Clarence W. Koch, 817 Donaghey Bldg., Secretary.

California, at Los Angeles, June 24. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Colorado, at Denver, June 18-22. N. C. Gunter, 610 Thatcher Bldg., Pueblo, Secretary.

Connecticut, at Hartford, June 26-29. Almond J. Cutting, Southington, Secretary.

Delaware, at Wilmington, June 19-20. W. S. P. Combs, Middletown, Secretary.

Florida, at Jacksonville, June 24-29. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Georgia, May 30. R. C. Coleman, Atlanta, Joint Secretary, State Examining Boards.

Kentucky, June 11-14. Robert L. Sprau, 970 Baxter Ave., Louisville, Secretary.

Indiana, at Indianapolis, June 18-21. J. M. Hale, Mt. Vernon, Secretary.

Maine, at Augusta, June 24-26. Alton H. Swett, 192 State St., Portland, Secretary.

Massachusetts, at Boston, June. Francis M. Cahill, State House, Boston, Secretary.

Minnesota, at Minneapolis, June 21-27. Paul Hagen, Crookston, Secretary.

Mississippi, at Jackson, June 18-20. T. Ford Leggett, Laurel, Secretary.

Missouri, at St. Louis, June 12-15. George E. Haigh, Central Missouri Trust Bldg., Secretary.

Montana, at Helena, July 8-11. Leonard A. Jenkin, 214 Medical Arts Bldg., Great Falls, Secretary.

Nebraska, at Omaha, and Lincoln, June 17-22. Mrs. Clark Perkins, Lincoln, Director of Examining Boards.

New Jersey, at Trenton, June 24-29. J. C. Forsyth, 148 W. State St., Trenton, Secretary.

New Mexico, at Albuquerque, June 24-26. J. J. Clarke, Artesia, Secretary.

North Dakota, at Fargo, June 9-12. W. E. Cole, Bismarck, Secretary.

Ohio, at Columbus, June 24. Morton H. Jones, 1553½ North Fourth St., Columbus, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, June 18-22. W. A. McCready, 1115 Highland Bldg., Pittsburgh, Secretary.

Rhode Island, at Providence, June 25-27. Albert L. Midgley, 1108 Union Trust Bldg., Providence, Secretary.

South Carolina, at Columbia, June 17. David Aiken, Winnsboro, Secretary.

Texas, at Dallas, June 17-21. R. J. Weber, 1014 Norwood Bldg., Austin, Secretary.

Utah, at Salt Lake City, July 17-20. J. H. Davis, First National Bank, Salt Lake City, Secretary.

Vermont, at Montpelier, June 24-26. H. B. Small, Burlington, Secretary.

Virginia, at Richmond, June 11. John M. Hughes, 715 Medical Arts Bldg., Richmond, Secretary.

West Virginia, at Charleston, June 24-26. H. C. Hill, Charleston, Secretary.

Wisconsin, at Milwaukee, June 17-21. S. F. Donovan, Tomah, Secretary.

COLORADO STATE DENTAL ASSOCIATION

The Colorado State Dental Association will meet at the Stanley Hotel, Estes Park, June 24-26.

E. E. Bailey, *President,*
Republic Bldg.,
Denver.

ARIZONA STATE BOARD OF DENTAL EXAMINERS

The next examination of the Arizona State Board of Dental Examiners will be held in Flagstaff, the week beginning July 1. All applications must be in the hands of the secretary at least fifteen days before the date of the examination. For further information, apply to

R. A. McCall, *Secretary,*
719 Professional Bldg.,
Phoenix.

MONTANA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Montana State Board of Dental Examiners will be held at Great Falls, July 8-11.

LEONARD A. JENKIN, *Secretary,*
214 Medical Arts Bldg.,
Great Falls.

UTAH STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Utah State Board of Dental Examiners will be held in Salt Lake City, July 17-20.

J. H. DAVIS, *Secretary,*
First National Bank Bldg.,
Salt Lake City.

GREATER NEW YORK DECEMBER MEETING

The Eleventh Greater New York December Meeting will be held December 2-6, at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS.

DENTAL SOCIETY OF STATE OF NEW YORK

The Sixty-Seventh Annual Meeting of the Dental Society of the State of New York will be held at Upper Saranac, with headquarters at the Saranac Inn, June 12-15.

A. P. BURKHART, *Secretary,*
57 E. Genesee St.
Auburn.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The Eleventh Annual Meeting of the American Dental Assistants Association will be held in New Orleans, La., November 4-8. Headquarters will be at the De Soto Hotel. For further information, address

LUCILE S. HODGE, *General Secretary,*
401 Medical Arts Bldg.,
Knoxville, Tenn.

ALUMNI ASSOCIATION OF TEXAS DENTAL COLLEGE

The Postgraduate Assembly of Texas Dental College for the Alumni Association will be held June 10-12, in Houston, at the Texas Dental College, Blodgett at Fannin. Members of the Alumni of the Texas Dental College should communicate with R. D. Snider, Secretary and Treasurer, Alumni Association of the Texas Dental College, Blodgett at Fannin, Houston.

FOURTH BELGIAN NATIONAL DENTAL CONGRESS

The Fourth Belgian National Dental Congress will be held, August 1-4 in the George Eastman Dental Institute in Brussels. Dr. Watry will present the general report at the opening meeting on "Prophylaxis and Early Treatment." There will be two general meetings, meetings of the scientific sections, which are three in number, and demonstrations. Those wishing to present original work, either papers or demonstrations, are invited to communicate with the president of the section interested. The presidents are as follows: F. Watry, 35 Rue Souveraine, Brussels (pure science, anatomy, physiology, pathology, bacteriology, prophylaxis, therapeutics, orthopedics, hygiene); Walter Fay, 67 Rue Marie-Therese, Brussels (applied science, operative dentistry, prosthetics); George J. Baudoux, 342 Avenue Louise, Brussels (maxillofacial surgery, anesthesia, radiology, dental electrotherapeutics); Cyris N. Fay, 53 Rue Capouillet, Brussels (demonstrations). For all information, apply to A. Joachim, president of the congress, 3 Rue de Hornes, Brussels, or L. Demoulin, General Congress Secretary, 15 Avenue Fonsny, Brussels.

INTERNATIONAL DENTAL FEDERATION

The twenty-ninth session of the International Dental Federation will be held in Brussels, August 4-10, in the George Eastman Dental Institute, where it will immediately follow the fourth Belgian Na-

tional Dental Congress. It is hoped that the official opening of the Eastman Institute will coincide with the F. D. I. meeting. For all information, apply to

CHARLES F. L. NORD,
General Secretary,
1 Scheveningscheweg,
The Hague,
Holland.

DENTAL HYGIENISTS ASSOCIATION OF THE STATE OF NEW YORK

The fifteenth annual meeting of the Dental Hygienists Association of the State of New York will be held at Saranac, June 12-15.

RAE SCHWARTZ, *Publicity Chairman,*
2685 University Ave.,
New York City.

DEDICATION OF PIONEER DENTAL BUILDING

A committee of the Kentucky State Dental Association has approved plans for the dedication of a building at Pioneer Memorial State Park, Harrodsburg, June 16, as a memorial to the itinerant pioneer dentists of the state. The building, built at Harrodsburg by the Taylor family, 100 years ago, will contain dental instruments and documents dating from Kentucky's pioneer days. The building was offered to the dental association by James L. Isenberg, director of the Kentucky Pioneer Memorial Association. June 16 will be designated Pioneer Tribute Day at Harrodsburg with the intention of making the date an annual day of tribute to the Kentucky pioneer. Members of the dental association committee on arrangements for the dedication are Joseph E. Johnson, A. P. Williams, J. H. Fullenwider, G. M. Edwards, C. S. Pearcy, E. C. Hume, C. A. Funk, G. H. Means, T. B. Beust, R. F. Canine, B. D. Rivers, E. H. Hubbuch, R. P. Thomas, R. L. Sprau, L. S. Block, A. M. Hardway, F. B. Hower, A. S. Nicholson, M. M. Eble, J. T. O'Rourke, Hugh Kellogg and Frank Mock, all of Louisville, George G. Bell, of Ashland, and Lee Crume, of Bradstown. Members of the dental profession are invited to attend the dedication.

INTERNATIONAL CONGRESS

The Ninth International Dental Congress will be held in Vienna, Aug. 2-9, 1936. The opening session, Monday morning, will be given over to the following sections: 1. Anatomy, Physiology, Histology, Pathology, Bacteriology and Pharmacology. 2. Full Prosthesis. 3. History of Dentistry, Documentation and the Professional Press. Tuesday morning: 4. Etiology and Treatment of Dental Caries. 5. Crowns, Fixed Prosthesis, Ceramics. 6. Teaching. Wednesday morning: 7. Anesthesia, Narcosis and Radiology. 8. Paradental Affections. 9. Public Dental Services and Social Legislation. Thursday morning: 10. Root-Canal Treatment and Focal Infection. 11. Partial Removable Prosthesis. 12. Metallurgy. Monday, Tuesday and Thursday afternoons will be devoted to clinics, Wednesday afternoon being left free.

A. JOACHIM, *President,*
Commission de la Presse,
3 Rue de Hornes,
Brussels,
Belgium.

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of the
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212 E. Superior Street, Chicago, Illinois

Dental Service in Hospitals

This neglected phase of hospital care is interestingly presented in an article by L. Roy Johnston which appeared in the magazine *Modern Hospital* for July, 1934. A reprint of this article may be obtained from the Library Bureau on request by sending 1½ cents postage.

Operative Radiodontia for the Child Patient

This reprint by W. S. Thompson from The Journal for December, 1934, has much information for the specialist in children's dentistry and for those interested in the use of the roentgen rays. Explicit instructions are given for making a complete roentgenographic survey of the child's mouth. This reprint may also be obtained by sending 1½ cents postage.

Professional Attitudes and Social Trends

This interesting and debatable article by H. E. Phillips appeared in the *Illinois Dental Journal* for March, 1935, and includes a discussion by H. W. Oppice. Another article by Dr. Phillips entitled, "The Profession and Third Party Practice," from *The Dental Digest* for January, 1935, may likewise be obtained. The postage for both of these reprints is 3 cents.

Dentistry as a Career—Circular 33

At this time of year when so many dentists are being asked to discuss dentistry as a vocation this Government circular on dentistry becomes very timely. It takes up briefly such topics as the dental specialties, compensation, number of dentists and ratio to population, state board examinations, time required for training, courses of study and expenses, and lists the dental schools. This material is in mimeographed form. Postage, 6 cents.

Dental Practice and Income

Abstracts of the book by this title by Leven and Beck, which was published by the University of Chicago Press in 1932, may be obtained by sending in 3 cents postage. This printed abstract contains fourteen pages including tables and graphs. The price of the bound volume of the book is $2. This may also be purchased from the Library Bureau.

Status of Dentistry in Our Economic System

This reprint of Michael M. Davis' article which appeared in The Journal for May, 1930, discusses such topics as family expenditures for dental care, family income and pay clinics. Postage, 1½ cents.

AMERICAN DENTAL ASSOCIATION

New Orleans, La. November 4-8, 1935.

HOTEL RESERVATION

In securing hotel reservations for the 1935 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

In case your first choice cannot be made, kindly indicate second and third choices. If none of your choices are available, the hotel manager will mail your application to the Chairman of Halls & Hotels Committee, who will make as favorable reservation for you as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing the room reserved for you in order that it may be available to others attending the meeting.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, NEW ORLEANS, LA., NOVEMBER 4-8, 1935.

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New Orleans, La.
Please reserve sleeping accommodations as noted below:

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.....	.....
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Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. G. O. Rosado, Chairman Halls & Hotels Committee, 827 Maison Blanche, New Orleans, La., who will attend to the assignment of this reservation.

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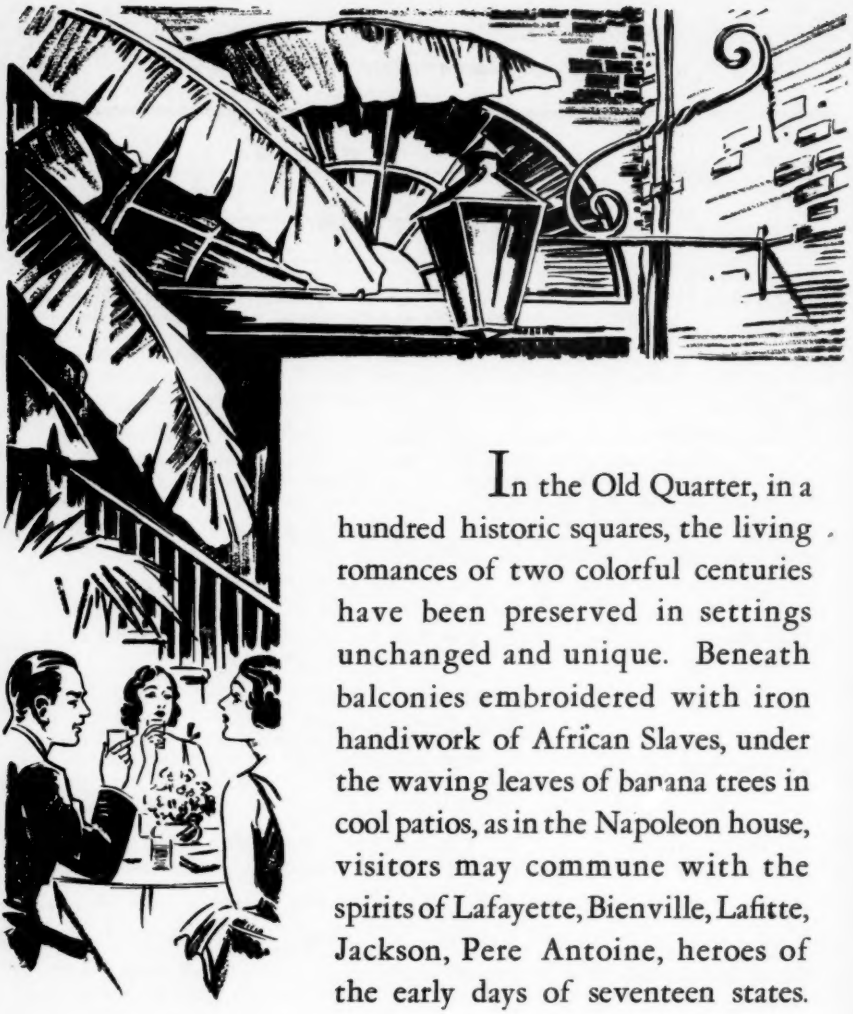

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